SCIENTIFIC AMERICAN

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THE PAINTING MACHINES AT THE WORLD'S FAIR.

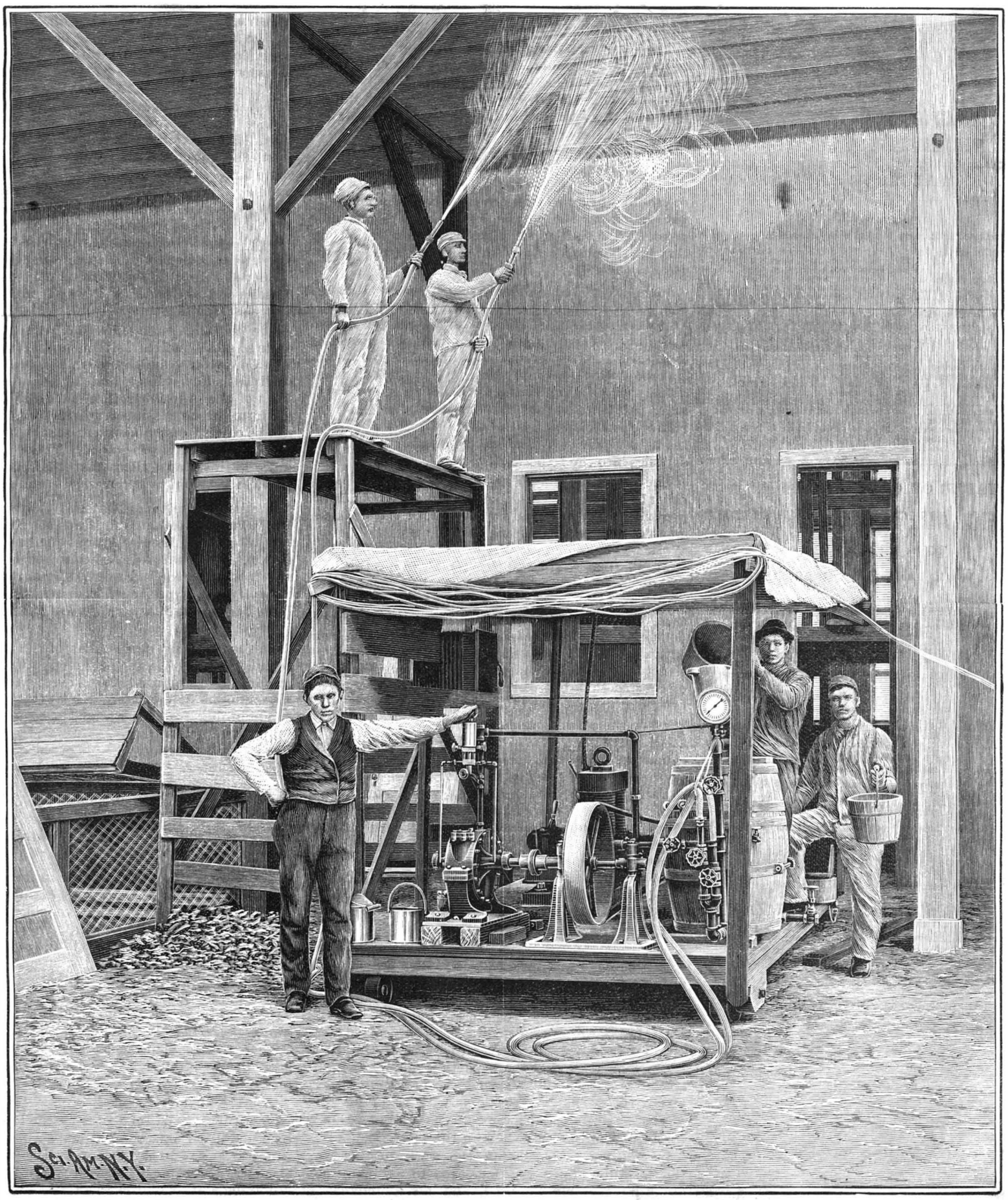
The following abstract of an article in *Harper's Weekly* explains the methods adopted with sufficient clearness; and the accompanying sketch shows the general arrangement of the apparatus:

In the painting of the buildings, the necessity for some method of covering their great areas which would be more rapid and less expensive than the brush was realized almost from the beginning of construction. Where such extensive wooden construction is used it is impracticable to dress all surfaces, and there exist many spaces inaccessible to the brush; while the rough or "whiskered" lumber makes the life of the brushes exceedingly short.

As soon as the placing of foundations had been commenced, careful consideration was given this subject, and efforts made to perfect a painting machine, but the earlier experiments were far from successful, and it was not until the buildings were nearly ready for their decoration that the subject was again taken up. Additional impetus was given by the fact that there remained insufficient time before the opening of the Exposition to accomplish so vast a work by hand. Some weeks were occupied in further experiments, Mr. F. D. Millet, Director of Decoration, and his assistant, Mr. C. Y. Turner, giving much attention to the problem. Meanwhile, the painting of the buildings then near completion progressed as rapidly as possible by hand in the usual manner. Finally, a machine which successfully sprayed color upon the surfaces to be covered, on the same general principle as the "atomizer," was produced and immediately set to work In this first successful apparatus, the color (in nearly all cases kalsomine) was passed directly through the rotary engine used for compressing air; but, because of its gritty nature, the wear was so great as to become a serious objection, and to render a more satisfactory method of introducing the color necessary, and further improvements were made, with successful results.

A rotary engine invented by Mr. T. G. Turner, of New York, driven by a five horse power electric motor, provides the compressed air in cases where the pneumatic system of the Exposition is not available. This engine furnishes the required pressure in a uniform manner, without the air chamber necessary to overcome pulsation in compressors operated upon the reciprocating principle. The engine, electric motor, color

(*Continued on page 262.*)



THE WORLD'S COLUMBIAN EXPOSITION—THE PAINTING MACHINE.

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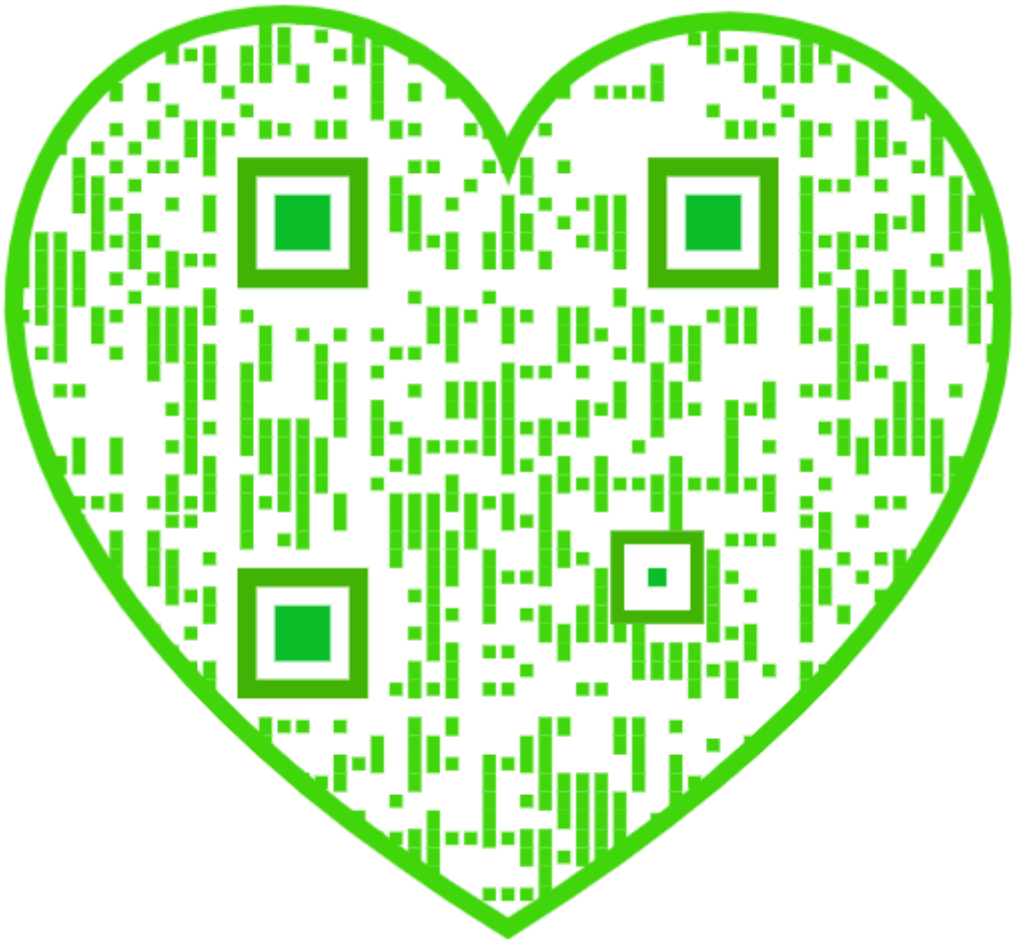

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THE WORLD'S COLUMBIAN EXPOSITION.

If there is any blame to be placed because the World's Columbian Exposition is not fully completed on the opening day, it should be laid on exhibitors and not on the Exposition management. Urgent letters and telegrams have been frequently sent out to exhibitors at different times calling their attention to the necessity of their being prompt in installing their exhibits if they wished to escape the rush of the last few days and be ready with their displays on the opening day. Everything possible seems to have been done by the Exposition to force matters, so that there should be no excuse for not being ready on time. The facilities for handling exhibits have been more than ample, although on a few occasions they have been pretty well tested. One serious drawback during the month of April has been the difficulty of securing sufficient skilled labor, especially carpenters, and also of getting teams enough to haul lumber and other supplies. A fair illustration of the embarrassments that have been met in this latter particular is that of an exhibitor who after a good deal of effort secured carpenters enough to do his work, and engaged a drayman to haul his lumber at seven dollars a load. The drayman hauled part of the lumber, and as he was waiting his turn at the Sixty-fourth Street entrance to get passage for his team into the grounds to discharge his load, another exhibitor who was looking for a man to haul lumber offered ten dollars a load. This offer was promptly accepted without completing the agreement with the first exhibitor, and so the carpenters who had been engaged to prepare the exhibit were without lumber to work with, and the exhibitor had to hunt up other means of getting his lumber.

The Exposition has done much less night work than it was expected would be necessary. In the mechanical department three shifts of men have been employed during April, because of the fact that this department was much behind in the work of installing the engines and boilers of the great power plant and of completing the steam and other connections. More ordinary labor has been at hand than could be employed. Every day for the last six weeks from a dozen or two to a hundred or more men have haunted the gate adjoining the service building seeking employment. With such an abundance of labor the Exposition has been able to push work with the greatest vigor by daylight.

Some idea of the manner in which work was rushed toward the last can be gained from the way in which Stony Island Avenue, which runs along the western boundary of the Exposition grounds, was macadamized. April 10 this avenue was full of deep ruts and sinkholes almost its entire length. On the 15th it was a finely macadamized road for a distance of about a mile. At the same time that this work was being carried on, provision had to be made for the passage of teams and drays which were bringing exhibits and supplies into the Exposition grounds.

The work of turfing lawns adjoining the State and other buildings in the northern part of the grounds was begun on the 10th, and by the close of the week was completed so far as building operations would permit. Work was begun on the promenades and walks about the same time, so that all that remained for the landscape department to do during the last week of the month was to complete the work of turfing the lawns adjoining those buildings where this work had been delayed and finish the work of hardening the more active arteries of travel. Temporary buildings and structures which had been necessary during the period of construction, but which had outgrown their usefulness, disappeared almost in a night.

When the middle of April arrived, a comparatively small percentage of the exhibits was installed, and the Exposition management found it imperative to let up somewhat on some of its stringent regulations, especially in regard to the driveways and narrow-tired vehicles. A very large number of exhibits enter the grounds on vehicles instead of arriving in cars, and up to the middle of the month it was imperative that these vehicles have extra width of tires, or they would not be permitted more than to enter the grounds, and all such exhibits had to be transferred to vehicles which were properly provided with the requisite width of tire. The number of exhibitors who had exhibits which could be installed with very little trouble inside of a few days was very large, and they did not make any effort toward preparing their exhibits until the latter part of the month. This brought in such a rush that, as a general rule, the original vehicles conveying the exhibits were permitted to drive into the grounds and buildings, thus furthering the work of the Exposition vehicles, and at the same time doing away with considerable delay in transferring. The more important driveways had been covered with planking since winter, so that no damage worth mentioning was done to the driveways by the narrow tires.

In addition to furthering the work in this way, the installing force was increased to as many men as could possibly be used, and an abundance of labor was held in reserve and at the service of the exhibitors who were in need of assistance. The lighting equipment to the buildings has been installed for several weeks and ready for use, and with the extra rush that began at the middle of the month, considerable night work became necessary. Quite an incredible amount of work has been done since the 17th of April, and as a result it is probable that most of the buildings will be practically ready on the opening day. Among these buildings in which exhibits will be practically complete are the Agricultural building, Mining building, Transportation building, United States government building, Fine Arts building, Fisheries building, and Transportation building.

April 10 was originally set as the last day upon which exhibits would be received, but there has been so much delay and such a comparatively small part of the exhibits had arrived up to this date that Director General Davis extended the time to April 30.

The telephone service at the Exposition grounds has been completed, and some days ago connection was made with the long distance wires, so that during the holding of the Exposition visitors will have every facility for talking with New York, Boston, Philadelphia, and other cities.

Although it became necessary to close to visitors the buildings in which exhibits were being installed during the month of April, other attractions were held out by the Exposition management, making it well worth while for visitors to go to the grounds to see these attractions themselves, in addition to the Exposition buildings and other sights. The leading attraction has been the flowers, and these have drawn many visitors, especially on Sundays. As soon as the display of cyclamens or "Persian violets" began to fade, other elaborate and very complete displays were made—among these pansies, cinerarias and English primroses. A great treat to lovers of flowers is promised soon, when the rhododendrons blossom. France and Germany have each contributed a splendid collection of these, which have arrived in most excellent condition. The French display will be made largely in the grounds adjoining the Woman's building. In addition to all these flowers there is also a very attractive show of early blossoming bulbs on the terraces in front of the Manufactures and Liberal Arts building and the Agricultural building. The greatest display of flowers when the Exposition is opened will be on the Wooded Island, which gives promise of being equal in its way to many of the other large displays of exhibits.

The opening ceremonies on May 1 will not be quite so select and exclusive as was at first proposed. The Council of Administration has decided that they shall be held outdoors and in the Grand Plaza in front of the Administration building. A temporary platform will be constructed from which the exercises will be carried out, and where seats will be provided for the 1,500 invited guests. There is such ample space in this Grand Plaza that it is believed that from 75,000 to 100,000 people can witness the ceremonies.

The heaviest piece of material that was handled in the Palace of Mechanic Arts was the shaft of the Allis two thousand horse power quadruple expansion engine. This shaft weighed thirty-three tons, or three tons more than the largest cylinder of this engine. No difficulty was experienced in handling and placing it in its bearings, but a good deal of time was consumed in the operation.

The engineering department of the Exposition has been at work during the past month outlining and arranging the work for making every preparation for a large number of tests. These tests include everything, from burning fuel oil with efficiency and economy to evaporating water for generating steam. There will also be a great variety of tests of the engines and electrical machines. All these tests will be as exhaustive as it is possible to make them, and they will be carried out on a much larger and more comprehensive scale than has ever before been possible. The results of these tests will be of great scientific value to the mechanical and industrial world.

The work of hanging pictures in the gallery of fine arts was begun the second week in the month and has been carried on energetically ever since. Each nation has pushed its own department, so that altogether this building will be nearer a state of completeness than most of the others. One of the interesting exhibits in this building is that which has been installed in the east wing by the French. This is what is called the Trocadero collection, and comprises a very large number of plaster reproductions of some famous French works. This collection is to remain permanently in this country, arrangements having been perfected to that end.

The elevated road which enters the grounds, and which will carry passengers from the heart of the city, has completed its commodious station immediately over the annex to the Transportation building. The station is so arranged that visitors can go from it to the adjoining station of the Intramural Railway without the necessity of going down one flight of stairs and up

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another. The elevated road has accomplished an immense amount of work during the month of April, and will have no difficulty in running its trains into the Exposition grounds in time for the opening ceremonies.

Exhibitors seem to have the staff mania, although in a somewhat milder form than the Exposition management. Nearly all of the larger and more pretentious booths and pavilions throughout the various buildings use staff to a greater or less extent for the purpose of ornamentation. In fact, there are very few booths outside of the smaller ones which are constructed without using it. In the Manufactures and Liberal Arts building is an especially elaborate display of staff ornamentation. In the midst of all this mass of staff it is a relief to look at the German section, which has quite a display of structural and fancy iron ornamentation. In the Mining building staff is not used quite so extensively, yet there are several pavilions which combine building stone or terra cotta and use staff ornamentation.

A national bank, established under the auspices of the Chemical National Bank of Chicago, has opened for business in one of the wings of the Administration building, and will do a banking business during the six months that the Fair is in operation. This bank is established both for the convenience of visitors and exhibitors, and special arrangements have been made so that there shall be as little red tape as possible in cashing checks or making drafts. The bank has been fitted up in a manner in keeping with its surrounding conditions, and will be well worth a visit of banking men.

Soda water fountains are among the most conspicuous structures in several of the larger buildings, and, judging by their size and capacity, the Exposition management expects a very thirsty crowd of visitors.

The railway terminal station at which passengers will arrive in the Exposition grounds by all the railroads, except the Illinois Central, was practically completed by the middle of April. It is a very fine appearing structure, and is especially convenient in its interior arrangements. The railway tracks entering it have been down for some months, and have been considerably used for the storage of freight cars, but have now been mostly cleared away to be ready to receive passenger trains. The switching plant which is to control the vast network of tracks is not quite completed, and there is some doubt as to whether it will be fully finished on the opening day, but it will be near enough completion to fully answer all the requirements.

THE AGRICULTURAL BUILDING.

The Agricultural building, next to the Administration building, is probably more conspicuous than any other building at the World's Columbian Exposition in the amount of statuary and other ornamentation. The architecture of the building is of the Classic Renaissance style. It fronts on the Basin and is directly opposite the south end of the Manufactures and Liberal Arts building. At the west of it is the South Canal, which separates it from the Palace of Mechanic Arts, while in the rear, or east of it, is what is called the South Pond. This building, like all the other Exposition buildings, is covered with staff. It is 800 feet long from east to west, and 500 feet wide from north to south. The cornice line, like all the other buildings surrounding the Basin, is 65 feet above grade. The main entrance is on the north face of the building, and on either side of it are mammoth Corinthian pillars, 50 feet high and 5 feet in diameter. Pavilions are reared at each corner and from the center of the building, the center one being 144 feet square. Curtains connect the corner pavilions, forming a continuous arcade around the top of the building. Each corner pavilion is surmounted by a dome 96 feet high, and on each of these domes is a group of maidens of heroic size, called the Horoscope Group. These figures are represented as holding aloft a globe about which is a zone with signs of the zodiac. The figures are made of staff, while the globes are of sheet copper. Each group represents a distinct race, one the Caucasian, another the Mongolian, another the Ethiopian, and the fourth the American Indian.

The main entrance leads through an opening sixty-four feet wide into a vestibule, and from this vestibule into the rotunda, which is one hundred feet in diameter. This rotunda is surmounted by a mammoth glass dome one hundred and thirty feet high.

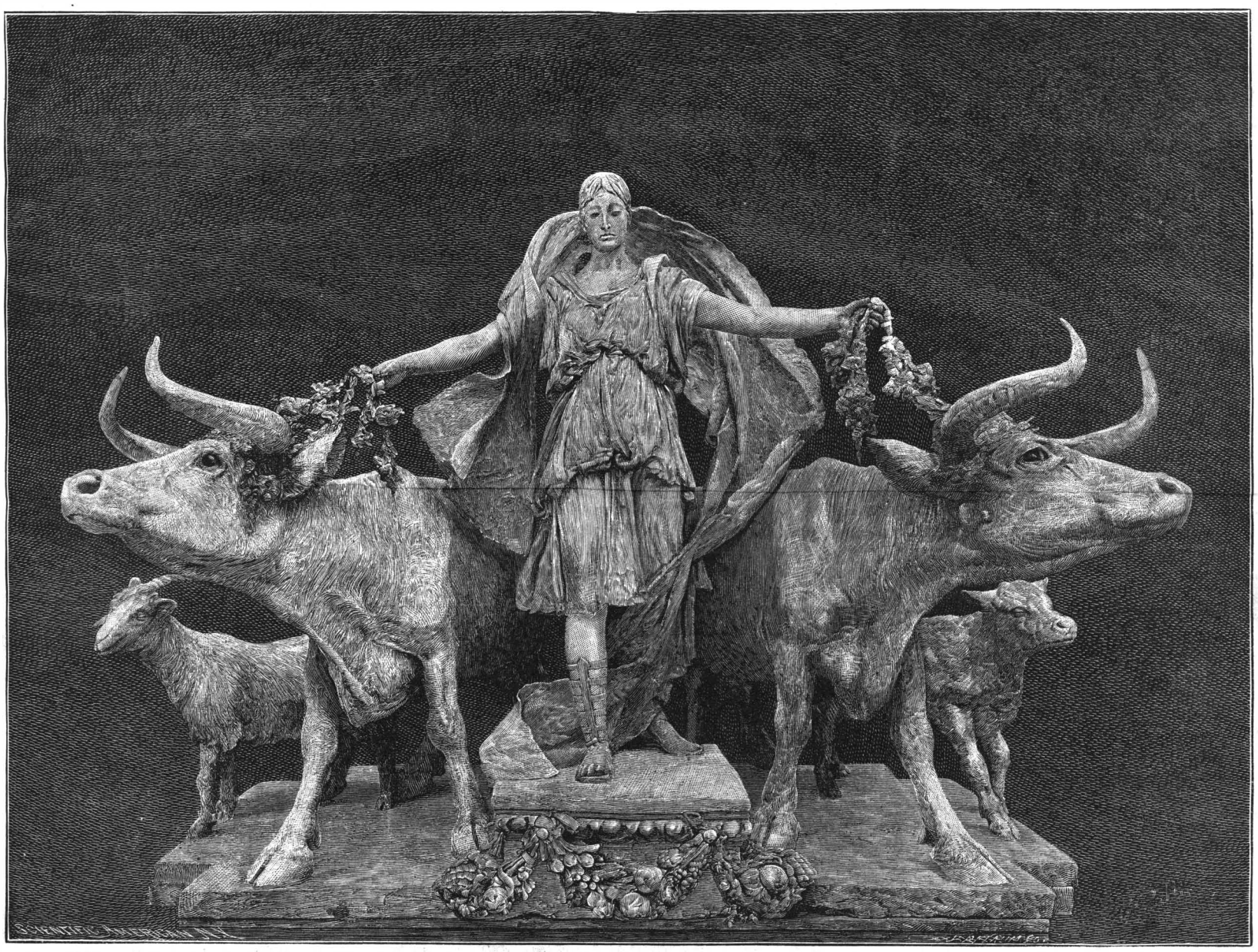
Perhaps the most conspicuous figure on the building is that of Diana the huntress mounted on the dome of the central pavilion. This is the figure of Diana that was formerly on the tower of the Madison Square Garden in New York City. Immediately over the main entrance is a winged figure illustrative of the "Victory of Ceres." This is a female figure with outstretched hands, holding a laurel wreath. On each side of this figure is the Ceres group. This group comprises two female figures holding between them a large shield on which is the word "Ceres," and underneath this is a garland of fruit. Cupids stand on either side of each of the figures, holding in their hands cornucopias which are running over with abundance.

On each corner pavilion are two reproductions of what is called the Four Seasons, making altogether eight of these groups. This group consists of four female figures representing the four seasons of the year, spring, summer, autumn, and winter. They are set back to back with their arms outstretched for sheaves of wheat extended above their heads.

Besides these groups of figures, which are decidedly Grecian in design, there are two other groups which are eminently rural and illustrative of agricultural pursuits. One of these is a horse group, the other cattle. There are four of the horse groups, two on the front of the building, one on the east end of the building facing the pier at which steamboats will land passengers, and one on the west front. The group comprises a figure of a Grecian plowman standing on a slightly raised elevation holding the handle of an ancient stone plow; two spirited horses are attached to the plow, yet held in check by a firm hand.

In the cattle group, which is likewise strongly Grecian, is a woman standing on a slightly raised pedestal holding a garland of flowers which encircles the necks of the cows. Standing on the right side of the group is the figure of a goat, and on the left is that of a calf. The number and positions of these groups are relatively the same as those of the horses. We give an engraving of this group.

On the exterior walls of the building, in strong relief, are fifty-four single figures of the Angel of Abundance holding a cornucopia which is overflowing with the fruits of the harvest. These figures are clothed in loose flowing robes and are classical like the others. Between the springs of the arches of the north, east, and west sides of the building are twenty-two more single figures in relief representing a female classically clothed, holding in her hands the signs of the zodiac. On the east front there are two spandrels, also two on the west and one on the north side. Four of these are the same. The two on the west side are immediately under the Horoscope Group and represent a pastoral



THE WORLD'S COLUMBIAN EXPOSITION—CATTLE GROUP, AGRICULTURAL BUILDING.

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scene of a shepherd with a crook in his hand, sitting on the right with two ewes and a lamb. The other spandrel represents the triumph of Ceres, and is on the north front. Ceres, the central figure, is represented as standing erect, holding a sheaf of wheat in her left hand and a shepherd's crook in her right. Further down on the pediment are other reliefs. On the left is a reproduction of Flora, Bacchus, and other mythological deities seated in a chariot drawn by two tigers. Over against this relief on the right hand is a figure of Mercury and pastoral deities in a car drawn by two dragons. The statuary is all the work of William Philip Martini of New York, with the exception of Diana, which is the work of Mr. Augustus St. Gaudens.

In addition to these decorations and ornamentations in staff, there are six mural paintings on the exterior walls, four on the west face and two on the east. These paintings consist of female figures gracefully draped, with flowers and fruit in their hands typifying the fruitfulness of nature. These paintings were executed by Mr. George W. Maynard. In the main entranceway are four mural paintings similar to the others in style and effect. One of these, representing "Fertility," carries a sheaf of wheat and a basket of fruit. The other figure, "Abundance," carries a shock of grain in one hand, while in the other there is an overturned horn of plenty, from which fruit and flowers are flowing out in abundance. Two other figures painted on the side walls of the entranceway represent mythological beings. One is a male figure driving a chariot drawn by dragons, the other a female figure in a chariot drawn by lionesses. The ornamental painting in connection with these figures was done by Charles Schladermaundt.

Thirty-seven States in this country and thirty-five foreign nations and states have exhibits in this building. The interior arrangement is such as to provide over fourteen acres of desirable space for purposes of exhibiting.

AN IMPROVED UNICYCLE.

A wheel which can be easily steered and propelled, and which is designed to enable a rider to attain a high rate of speed, is shown in the accompanying engraving, and forms the subject of a patent issued to Mr. James Imlah, of Barre, Vt. This wheel has an inner wheel supporting a suitable framework and having a double rim, the two parts of which engage ball bearings of inner annular flanges connected by spokes with the tire of the outer wheel, so that as the latter travels on the ground the inner wheel rolls off on the flanges, and the rider in his seat holds the framework in normal position, the inner wheel not revolving. Between the two ball bearings in the rim is an internal gear in mesh with a gear wheel on a shaft in the framework, a sprocket wheel on this shaft being connected with a similar wheel on the treadle shaft, by the operation of which the large gear wheel is rotated to give motion to the exterior wheel. By means of a brake lever pivoted on the steering lever, a brake may be applied to the shaft of the large gear wheel to stop the machine. The steering lever is arranged in front of the rider's seat, and by means of the mechanism connected therewith friction rollers may be brought into engagement with opposite edges of the double

IMLAH'S UNICYCLE.

rim, the roller coming in contact with one edge of the rim, turning the wheel in the opposite direction, and when engaging the other edge moving the wheel in the reverse direction. One can easily get into the machine by turning the framework half way around, allowing the saddle to come back into place after stepping in.

THE PEARL BUTTON INDUSTRY.

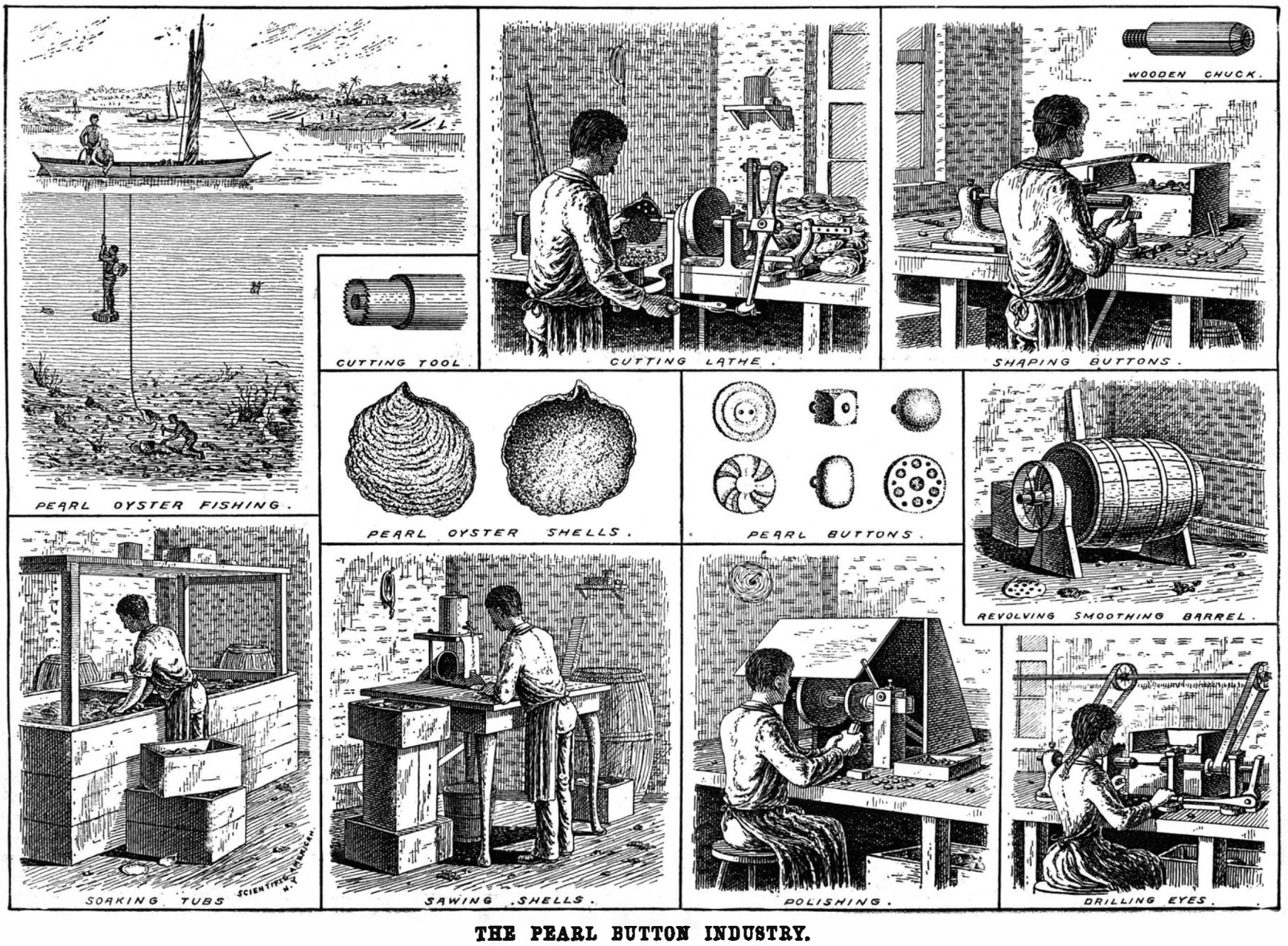
The pearl oyster shells from which pearl buttons are made come principally from the coast of Australia and the South Pacific islands. The oysters are gathered in the spring, beginning in the month of March and ending in May. Fully 200,000 persons are employed in gathering the oyster during the season. When the boats arrive at the grounds, the divers are stripped naked and well oiled; their noses and ears are stuffed with cotton and a sponge dipped in oil fastened to one of their arms. Armed with knives, they and their baskets are then lowered to the bottom of the sea by means of large 40 or 50 lb. stones attached to ropes. The divers remain under water from 50 to 80 seconds. As soon as a basket is filled it is drawn up and the diver comes up to the surface. After resting a few moments he again descends, filling the basket again, and so on until he becomes exhausted, when another man takes his place.

The fishing is done in about 8 to 10 fathoms of water. The shells are imported into this country. There are two varieties. the white and the black or smoked pearl. They run from 2 × 3 inches to 6 × 8 inches in diameter, the largest of the shells being about a half inch in thickness near the joint. The shells are very brittle when they arrive in this country, and have to be soaked in water before they can be worked. This soaking brings them back more to their natural state. After soaking in tubs they are taken to the cutting lathe.

The operator, taking the shell in one hand, by means of a lever forces a hollow saw-edged tool against the shell, which cuts its way through, the circular piece dropping out of the hollow tool when drawn back by the lever. This operation is continued until the entire shell is perforated. The teeth of this sawing tool are 1-32 part of an inch in length.

These circular pieces are then taken to another lathe to be trimmed and formed. The circular piece of pearl is placed in the end of a slotted dogwood chuck which is hollowed out the same shape as the button. The attendant, by the use of sharp-pointed tools made of saw files, trims and forms the button as it revolves. Fancy designs on the faces of the buttons are made with ball and circular saw-shaped tools, which are placed in lathes, the operator holding the button in his hands and pressing it against the tool as it revolves. The drilling of the eyes is also done on a lathe, the button being placed in a chuck similar to that on the forming machine. The attendant by means of a lever forces the drill against the button, which cuts out the eyes.

For smoothing off ridges the buttons are put into a revolving barrel with a mixture of powdered pumice stone and water. The polishing wheels are 6 and 14 inches in diameter and made of 54 separate pieces of unbleached muslin clamped together at the center on the shaft of the machine. The revolving of the shaft causes the circular pieces to stick together, forming a perfect wheel. The attendant puts a button in the end of a small wooden chuck, rubs a little rouge made of a mixture of tripoli, flour and tallow, and presses it up against the muslin wheels, which give it a beauti-



THE PEARL BUTTON INDUSTRY.

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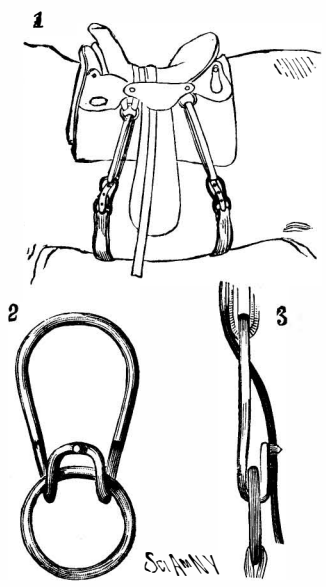
ful polish. These wheels make 3,000 revolutions per minute.

After polishing the buttons are placed on cards and ready for sale. Fifty hands can turn out about 150 gross per day of buttons. The shells cost from 40 to 50 cents per pound. The buttons when finished cost from 40 cents to $25 per gross wholesale. The annual consumption of pearl buttons in the United States amounts to about $3,500,000.

The sketches of this subject were taken from the plant of E. Huebner & Son, Newark, N. J.

AN IMPROVED SADDLE ATTACHMENT.

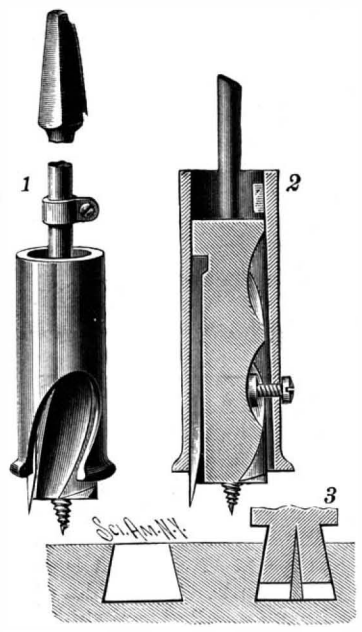
A combined loop and hook, for quickly and easily forming the connection between the saddle straps and belly girths, and securely fastening them in position, is shown in the accompanying illustration, Fig. 1 showing the loop and hook in use on a saddle, Fig. 3 being a side view, and Fig. 2 showing the attachment to a girth ring. This improvement has been patented by Mr. John F. Kohler, No. 906 Columbus Avenue, New York City. The elongated metallic loop is slightly larger at its upper end, so that a strap may be passed through it several times if desired, and at the lower end it is doubled upon itself to form a hook adapted to engage the girth ring, a portion of the hook surface being flattened and having an outwardly extending stud to engage perforations in the saddle strap. The tension of the girth and straps is designed to hold the saddle in place so that it cannot accidentally get loose, and the strap is easily and quickly fastened to the stud.



KOHLER'S SADDLE ATTACHMENT.

A TOOL TO DRILL CONICAL RECESSES.

Fig. 1 shows a perspective and Fig. 2 a sectional view of an improved tool, patented by Mr. Charles A. Cutting, of Middletown, Va., and which may be used to conveniently drill conical recesses to receive posts, dowels, etc., as indicated in Fig. 3. At the lower end of the bit, between the twists, is held a removable cutter, an offset on its upper end fitting into a recess in the upper end of the bit and forming a pivot for the cutter to swing outward on, so that it will stand at angles to the axis of the bit. A shell or sleeve, slightly enlarged at its lower end, fits loosely over the cutter and bit, the lower end of the sleeve having a recess through which shavings may escape. A clamp on the shank of the tool regulates the depth of the cut, which is limited by the clamp coming in contact with the upper end of the sleeve. The space formed by the twist in the bit is engaged by a plate on a screw screwing in the shell, so that in revolving the tool the shell revolves with it, while the tool is free to move downward in the shell as the latter rests on the material being bored. A lug in the upper end of the shell prevents the bit from being accidentally withdrawn therefrom. In operation, as the tool cuts into the material, and its lower end moves out of the shell, the point of the cutter is pushed outward to assume an angular position relative to the bit, thus forming conical recesses, as shown in Fig. 3. A wedge set in the bottom of this recess is adapted to engage the bottom of a post or dowel, splitting it and wedging its sides in contact with the walls of the recess.



CUTTING'S RECESS BORING TOOL.

PITCH pine beams will shrink in thickness from 18⅜ inches to 18¼; spruce from 8½ to 8¼; white pine, from 12 inches to 11⅞; yellow pine, a trifle less. Cedar beams will shrink from a width of 14 inches to 13¼; elm from 11¾ to 10¾; and oak from 12 to 11⅜ inches.

The Wire Gun.

The first public test of the Brown segmental wire-wound gun was made at Birdsboro, Pa., April 15, and was attended with much success. Government exprts, representatives of foreign powers and a number of invited guests from New York, Philadelphia, and other cities were present. Three shots were fired, and the gun successfully withstood a pressure which the experts declared would blow any other gun in the world to atoms. The tests broke all records, and one of the enthusiasts declared they placed the United States in the van in gun making.

On the third and final test the charge was thirty pounds of powder, the projectile sixty pounds weight. The gun recoiled about 15 feet, and a section of the stone quarry rose in the air as the projectile struck.

The test gauges were set to show a pressure of between 40,000 and 60,000 pounds; it was found that the pressure had gone beyond the larger figure and exceeded the means at hand for measurement. The pressure was declared by experts to be something above 70,000 pounds. The standard army requirements are only 37,000 pounds.

The gun has just been finished as a sample for the United States government. It was built at the Diamond Drill Works at Birdsboro, under the personal supervision of John Hamilton Brown, the inventor. It is built on a new system, which is the winding of a steel wire around a segmental core of steel. The core is made of twelve pieces of steel 19 feet long, and with a cross section like the key of an arch. The core is 3 inches in thickness at the breech, and three-quarters of an inch at the muzzle.

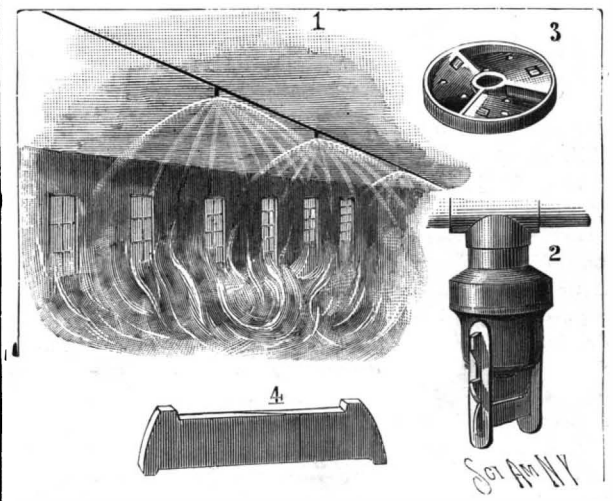
This is wound with thirty-three layers of steel wire seven one-hundredths of an inch in thickness. The gun is about 15 inches in diameter at the breech and 10 inches at the muzzle. The gun is 1⅘ feet in length and weighs three and one-third tons.

Venetian Mosaics for the Fair.

The British vice-consul at Venice says that the splendid mosaics now produced there continue to take the first place in the artistic markets of the world. Among the important works recently executed by the Venice and Murano Company, a well-known mosaic manufactory, is a large mosaic panel representing Columbus being received by Queen Isabella and King Ferdinand of Spain, after his return from America. This panel, measuring about 200 square feet, shows Columbus when kneeling before the sovereigns, presenting to them the natives of the newly discovered land and some products of the soil. The persons represented are about thirty-eight in number, many of them of the natural size, formed in three principal groups. In the most important is Columbus, having at his side the Crown Prince, and the sovereigns surrounded by the dignitaries of the court, ladies and nobles, and pages holding the standards. In the middle group, but more to the left, are the native Indians, and near the entrance of the hall other Spanish nobles, and the companions of Columbus. The gorgeous and various attires of all the figures, their warlike implements, the splendid stuffs of all sorts and tints, the rich decoration of the hall, the pageantry of the court, the strange costumes of the natives in full contrast with the others, and the various attitudes of all these personages, form a whole in perfect harmony with the details of the scene, owing to the excellent distribution of the figures and the perfect fusion of tints. The work is so delicately executed, says the vice-consul, that no one can believe that the panel is not painted until on touching it he discovers that it is entirely composed of small enamel cubes, put together without any aid of color or cement, and worked according to the mode of the old Venetian mosaic school. This panel is to form the pendant of another, representing Columbus landing in America, and which will shortly be executed by the Venice and Murano Company. These mosaic works are executed for Mr. H. Furber, of Chicago, who is now building a palace near the Exhibition, which is to be called Columbus Palace, and will, it is said, be the largest in America. The two panels are to be placed in the entrance hall. The author of the cartoons is Prof. Chev E. Paoletti, an artist well known in Venice, and affirmed to be one of the best painters who still maintain the traditions of the great Venetian school. As a work of art, the mosaic is said to be the most remarkable modern specimen ever exhibited.

AN AUTOMATIC SPRINKLER TO PUT OUT FIRES.

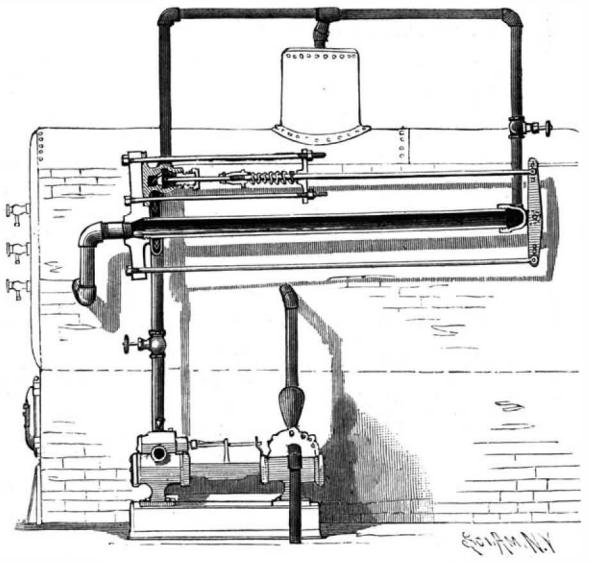
Many of the insurance companies now stipulate for the employment of automatic sprinklers in manufacturing establishments which they underwrite, or, in the absence of such sprinklers, charge a higher rate for insurance. A sprinkler of this kind, which has been patented by Mr. Thomas Holmes, of Chicago, Ill., is shown in the accompanying picture, Fig. 1 representing the operation of these sprinklers in a room, and Fig. 2 being a larger perspective view of the device attached to a pipe by which water is supplied under pressure. Within the body of the sprinkler a valve is held to close the water supply opening, and to have a limited fall as the valve opens, the stem of the valve extending below the body and having on its lower end a disk-like turbine water sprinkler, shown in Fig. 3. It may have any number of spray perforations, and is adapted to rotate freely, the perforations being so inclined that the water pressure causes its rapid rotary movement. Within two pendent links supported from lugs on opposite sides of the body of the sprinkler is held a saddle bar, on which the head of the valve stem rests, and this bar rests upon a coupling bar, shown in Fig. 4, whose outer ends have lips which lock over the lower edges of the pendent links. This coupling bar may be made entirely of fusible metal, but preferably consists of two pieces of brass or other metal, lap-folded and united, as shown, by a solder which will fuse at a temperature below that of boiling water. The fusing of this solder, when a fire starts in the vicinity of the sprinkler, causes the two pieces of the coupling bar to be separated, lets down the saddle bar, pushing the pendent links outwardly, and allows the valve with its turbine disk to drop, the force of the escaping water then causing its widespread spraying distribution. Further information relative to this improvement may be obtained of Mr. C. H. Matthiessen, P. O. box 655, Chicago, Ill.



HOLMES' AUTOMATIC SPRINKLER.

AN IMPROVED FEED-WATER REGULATOR.

An automatically operating regulator of the feeding of water to a steam boiler, designed to hold the water in the boiler at all times at about its normal level, is shown in the picture, and forms the subject of a patent issued to Mr. Emory M. Carr, of New Castle, Ind. A slightly inclined pipe arranged alongside the boiler, with its upper end at about the normal water level, is connected by a pipe at its lower end with the water space of the boiler, and a pipe connects its other end with the steam space. Both ends of the longitudinal pipe are secured in heads, and on the head on its higher end is fulcrumed a lever, the lower end of which is connected by a longitudinal rod with the other head, while its upper end is connected by a rod with a valve in the steam pipe connecting the boiler with the feed-water pump. On the latter rod also is a coiled spring, normally holding the valve to its seat. With the water at its normal height, it fills the longitudinal pipe, and the feed pump is still, but as the water falls the pipe becomes filled with steam, the heat of which causes an expansion of the pipe and an outward movement of the lever fulcrumed on its upper end, thus pulling the rod connected with the valve in the steam pipe leading to the feed pump, and setting the latter in motion. As the boiler is filled by the incoming water the longitudinal pipe is also filled, and by its contraction as it cools the lever fulcrumed at one end is moved to close the valve in the steam pipe leading to the feed pump, the spring on the rod also assisting to close the valve.


CARR'S FEED-WATER REGULATOR.

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THE PAINTING MACHINES AT THE WORLD'S FAIR.

(*Continued from first page.*)

reservoir, etc., are mounted upon a truck which is readily moved from place to place. Into the reservoir the kalsomine is poured after having been properly mixed, and through it, from the bottom, there is forced a jet of air at a pressure of 18 to 20 pounds per square inch. In this manner the contents are kept agitated, and any deposit of sediment prevented. From the top of the reservoir the air is then conducted through a pipe to a point on the outside near the base, and here, by means of a half inch regulating valve, the color passes into the main air pipe, where it unites with the compressed air, forming a spray which passes into an ordinary three-quarter inch garden hose of any desired length. At the end of this hose is attached a nozzle, consisting of a brass pipe, flattened out so as to leave an aperture one-sixteenth inch wide and about 1½ inches long. One machine furnishes spray for two nozzles, each being operated by a skilled painter, who applies the color as one would handle a lawn-sprinkling hose. While trained painters are not absolutely necessary to the proper operation of the appliance, it has been found that better results are obtained by their employment. From ordinary scaffolding the color is sprayed upon the woodwork in sections, the machine being moved as the work progresses.

In many cases in the main buildings the use of a separate compressor has been unnecessary, the Exposition having in operation throughout the grounds underground pipes supplying compressed air for the operation of the ejectors in connection with the sewerage system. Where this power is available, the process is the same, except that the compressed air is heated by means of a coil adjusted in a salamander containing a coke fire. This secures the proper temperature, and enables the machine to work in very cold weather, when hand painting is impossible. Heating is not required where individual compressors are used, because the friction of the machine raises the temperature of the air to the required point.

There are now at work within the grounds fourteen machines, each with a force of three men, working eight hours a day.

A comparative test recently made showed that one painter could cover with a brush a daily average of about eight squares, while a machine upon similar work accomplished with equally satisfactory results nearly twenty times this amount, there being, however, two nozzlemen for each machine. As high as 304 squares have been done by one machine in eight hours, but this was an exceptional case, where all conditions were favorable for rapid work. On December 8, 1892, a number of machines began work upon the interior of the Manufactures building. At the end of three weeks, with a daily average of about 30 men, 1,332,669 square feet, half of the entire surface to be covered, had been finished. One of the advantages of this system is that in the coldest weather, when brushes are frozen solidly in transit from pail to wall, the machine work goes actively ahead.

The only comparison between machine and brush whereby the former suffers is in the amount of material used. Where 20 barrels of kalsomine are required for hand work, the machine will use 21. With a saving, however, in time and labor of about 20 to 1, the small amount of waste in material is scarcely worthy of consideration.

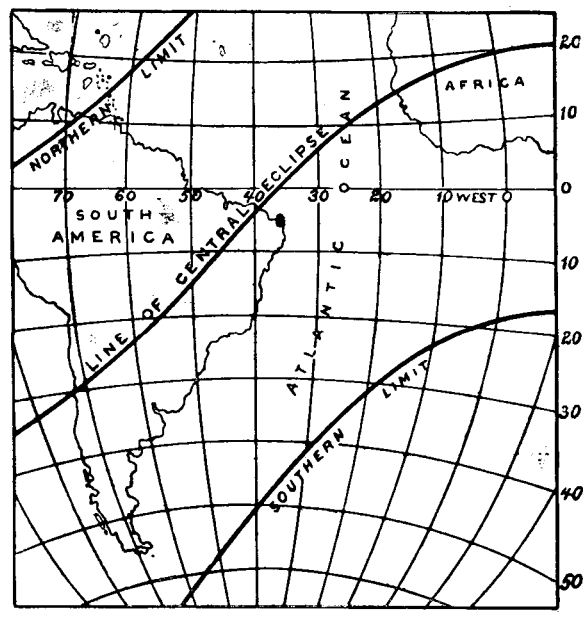
Luminous Air.

Dr. Philip Lenard, of Bonn, assistant to Professor Hertz, has recently exhibited a novel light produced by electric oscillations, and a paper has been read on the subject before the Royal Prussian Academy of Sciences, at Berlin. Hertz has shown that the rays proceeding from the cathode of a Geissler tube, which are capable of exciting phosphorescence, will pass through thin metal. If it were practicable to find a sheet of metal foil thick enough to be airtight and opaque, yet thin enough to be permeable by this discharge, it would be possible to allow these rays a passage into the open air by closing an opening in a discharge tube with such a piece of foil. This idea has been realized by Dr. Lenard by means of an ingeniously arranged apparatus and a hammered aluminum plate 0 003 millimeter thick. This plate forms in the apparatus in question a shutter which Dr. Lenard calls the "window," because while quite impermeable to air and light, it allows the rays from a cathode at a distance of 12 centimeters to penetrate it freely. These rays render the air faintly luminous. A halo of bluish light surrounds the "window," and is moderately bright only on its surface. At the same time a strong odor of ozone is recognizable. Substances capable of phosphorescence, if held near the "window," shine with their peculiar light on the side nearest to it. All the phenomena of phosphorescence cease if a magnet is so applied to the discharge tube as to repel the cathode rays from the inner side of the "window." The atmosphere is a dull medium for the cathode rays to penetrate, coal gas is more permeable, and so is hydrogen, while oxygen and carbonic acid are less permeable than air.—*Elec. Engineer, London.*

THE TOTAL SOLAR ECLIPSE OF APRIL 16.

Professor Pickering, of the Harvard College station at Mina Aris, in the Chilean Andes, reports that the atmospheric conditions on the day of the eclipse were all that could have been wished for, and that the results will be satisfactory to the highest degree. He says, in a dispatch printed in the New York *Herald* on the morning of April 17: "The corona seen, generally speaking, resembled the corona of 1871, as graphically portrayed by Captain Tupman, and complex, like that observed by Liais in 1857, which extended some 700,000 miles from the sun. There were four streamers, two of which had a length exceeding the sun's radius, or stretching out more than 435,000 miles. Several dark rifts were visible, extending directly outward from the moon's limb to the utmost limit of the corona. Filaments were numerous about both the solar poles. Compared with the corona of January 1, 1889, the corona just observed was more brilliant. During the total eclipse several flaming solar prominences attained great distinctness and brilliancy. Within the streamers no rapid movements were observed, but the impression of the scene was rather one of calm and tranquillity. The streamers were widely extended at the base, but not very long. The moon appeared of almost inky darkness, with only enough illumination at the edge of the disk to make its rotundity conspicuous, while from behind the orb streamed out on all sides the radiant filaments, beams and sheets of pearly light, which formed an irregular 'star-like decoration,' with the black lunar globe in its center. The inner corona was of dazzling brightness, but still more dazzling were the eruptive prominences, which blazed through it—to use the words of Professor Young—'like carbuncles.'

"The spectroscopic observations secured are very promising. As the eclipse progressed the temperature



PATH OF THE ECLIPSE OF THE SUN, APRIL 16

of the air fell considerably below its normal. The lowest reading of the thermometer occurred several minutes after totality. Upon review of all the observations, it may be said the corona was a combination of that of 1871 and that of 1857, as drawn by Liais. The photographs obtained were very numerous and highly satisfactory."

In a subsequent dispatch it is stated that the first contact, when the edge of the moon began to touch the edge of the sun, occurred at 7h. 17m. 6s. A. M. The second contact, when the eclipse became total, was at 8h. 19m. 9s. The third contact, marking the cessation of the total phase, was registered at 8h. 21m. 59s.; and the final contact, at which the moon left the sun's disk, at 9h. 30m. 10s.

Professor Pickering says the results of photographs obtained with the differential spectroscope give twenty lines in the "reversing layer" of the solar atmosphere —the shallow stratum of gas lying just above the photosphere and known to contain the vapors of many elements commonly found on our globe. Twelve of these brilliant-colored spectral lines were seen through the telescope. This is said to be the first time that these lines have been successfully photographed.

Seven prominences were observed, estimated to have attained a height of 80,000 miles. The integrating spectroscope showed red and yellow lines, two green lines and one blue in the corona.

A dispatch received by Director Holden, of the Lick Observatory, from Professor Schaeberle, states that the expedition sent to Chile from that institution to observe the eclipse was also signally successful, and that fifty photographs were obtained.

There were eight expeditions stationed along the line of totality for the observation of this eclipse, of which the United States observers selected locations upon the Andes, in Chile, where the atmospheric conditions were most promising. The expedition of the Harvard College Observatory, under Mr. Bailey, Professor Albrech, of Valparaiso, co-operating with him, took their position at an altitude of 3,700 feet. Professor Schaeberle, from the Lick Observatory, went a few miles further north, to an altitude of 6,600 feet. At both these stations photographs were taken in addition to the visual observations. Next in order comes the expedition of the Argentine Republic, upon their own territory, under Mr. Thome, long known in the astronomical world from his association with Dr. Gould in the production of the great catalogues of southern stars, which complement Argelander's catalogues of the stars of the northern heavens. In Brazil, upon the Atlantic coast, are three parties—an English expedition under the direction of Mr. Taylor, forty miles from Ceara; a French party in the same neighborhood, and a Brazilian party under the well known M. Cruls. On the coast of Africa there are two expeditions—an English expedition located sixty miles northerly from Bathurst, under the direction of Professor Thorpe, and a French expedition a few miles further to the southward.

When the photographs and full details from all these sources come to hand it is expected that they will form an important addition to our knowledge of solar physics, and possibly afford material aids in lines of investigation whose connection therewith has not heretofore been seen.

The Italian Torpedo Cruiser Arethusa.

The Arethusa is another of those ships of high velocity and great offensive powers which are soon to be added to the Royal Naval Squadron. Her principal dimensions are the following: Length, 70 m.; width, 8·20 m.; depth, 5·43 m.; tonnage displacement, 846·44 t. The armament is composed of six torpedo-launching tubes, five rotating on the deck and one fixed on the bow, of one cannon of 125 millimeters, of six cannons of 57 millimeters. Her defense consists of a deflective deck and coal bunkers super-added to it. The machinery, according to the contract, should be of 4,000 H.P., but the builders of the Arethusa, Orlando Bros., have been able to obtain the showing of 4,422 H. P. They consist of two vertical triple expansion engines supplied from four locomotive boilers with forced ash pit draught. Allowing for the great increase of horse power obtained, the speed has reached 21 knots as a maximum, and 20·7 knots as a mean of three hours trial, that is to say, about a mile in excess of the other ships of this type existing in our navy. The Arethusa with natural ventilation makes 18 knots, so under both natural and artificial draught she is the fastest ship in our navy next to the Piedmont. The plans of the ship are due to the lamented Commander Vigna, those of the engines to the engineer Salvatore Orlando. The guns come from the Armstrong establishment of Pozzuoli.—*Revista Nautica.*

Incandescent Lights.

The chemical composition of the mantle in the new Auer incandescent lights has lately been discussed in the *Journal fur Gasbeleuchtung.* The substance deposited on the cotton web consists of the oxides of metals of the cerium and zirconium groups, which exist in various minerals, for the most part in combination with silicic acid. The oxides are extracted from the minerals, and dissolved in nitric acid. This solution forms the bath in which the cotton web is dipped, and impregnates the latter so thoroughly that, on drying and burning, a finely meshed mantle of the oxides remains. It is necessary that the oxides employed in the manufacture should be free from iron, as that metal exercises a marked deleterious influence on the radiating power. Few experiments have been made to test the durability of mantles made from different oxides, but those of complex composition appear to last best. M'Kean has demonstrated that thorium oxide develops the highest illuminating power from the gas, while oxide of lanthanum ranks next, followed in order by the oxides of yttrium, zirconium, and cerium. A mixture of two-thirds oxide of thorium and one-third oxide of yttrium is recommended for obtaining the highest lighting efficiency. He has also shown that the tint of the light is altered by the constitution of the mantle. The oxides of lanthanum, thorium, and zirconium all give a white light, the oxides of cerium, didymium, and niobium, even in small amount, give a yellow tint to the light, while cerium oxide in large proportion gives a red light, and oxide of erbium a green one.

A Good Watch for One Dollar and a Half.

In another column will be found the advertisement of Messrs. R. H. Ingersoll & Bro. of their $1.50 watches. We can say of this article it is an excellent time keeper, and fully answers to all they claim for it. The fact they are able to put it on the market at the price stated is a remarkable evidence of American ingenuity, while it also indicates the wonderful perfection to which clock and watch mechanism have been brought in this country.

The little electric engine advertised by the same firm is likewise a gem in respect to mechanical perfection and operation, yet they sell it at the low price of one dollar.

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POSITION OF THE PLANETS IN MAY.

VENUS

is morning star until the 2d, then evening star. She is in superior conjunction with the sun on the 2d, at 4 h. 15 m. A. M., passing from his western to his eastern side, and becoming evening star. She will be invisible for about six weeks on account of being so close to the sun, and will then emerge from her seclusion and gradually increase in size and brilliancy, until she stands highest on the celestial roll call, the sun and moon alone excepted. Observers will welcome her presence during the summer evenings, and rejoice in the light of her radiant luster as the months roll on. Her reign continues during autumn and winter, for she only reaches her greatest eastern elongation from the sun on December 6, her period of greatest brilliancy on January 12, 1894, and her inferior conjunction on February 16, 1894. The queen of the stars until that time will be most conveniently situated for observation.

Venus is in conjunction with Neptune on the 25th at 1 h. 35 m. P. M., being 1° 36′ north. It will be noted that the inferior planets at superior conjunction seem to pass from the sun's western side to his eastern, while the superior planets at conjunction pass from the sun's eastern side to his western. The result is that the number of planetary conjunctions is increased, as in this case, where Neptune moving westward toward the sun meets Venus moving eastward from the sun, and their conjunction necessarily occurs.

The moon, when one day old, is in conjunction with Venus on the 16th, at 1 h. 6 m. A. M., being 3° 4′ north.

The right ascension of Venus on the 1st is 2 h. 37 m., her declination is 14° 28′ north, her diameter is 9″.8 and she is in the constellation Aries.

Venus rises on the 1st at 5 h. 2 m. A. M. On the 31st, she sets at 7 h. 54 m. P. M.

SATURN

is evening star. He continues to hold his place as the only large visible planet and is finely situated for observation, with the brilliant Spica on the southeast, and with Gamma Virginis on the east, the beautiful double star that has been his companion for months. The planet is still retrograding or moving westward, and observers will note that the distance between him and the double star increases during the month. Saturn makes his transit on the 1st at 9 h. 50 m. P. M., and is plainly visible in the southeast, as soon as it is dark enough for the stars to come out. He cannot fail to be recognized, from the description given, and this excellent opportunity for the telescopic study of the ring-girdled planet and the noted double star should be improved.

The moon, three days after the first quarter, is in conjunction with Saturn on the 25th, at 3 h. 48 m. A. M., being 43′ south. The conjunction is invisible, occurring when moon and planet are below the horizon. The moon occults Saturn and Gamma Virginis for observers in the southern hemisphere who are rightly located.

The right ascension of Saturn on the 1st is 12 h. 31 m., his declination is 0° 23′ south, his diameter is 17″.9, and he is in the constellation Virgo.

Saturn sets on the 1st at 3 h. 48 m. A. M. On the 31st, he sets at 1 h. 47 m. A. M.

JUPITER

is morning star. He makes rapid progress westward from the immediate vicinity of the sun, rising on the 31st 1 h. 8 m. before the sun, when he becomes visible as morning star to sharp-sighted observers. Jupiter's diameter when farthest from the earth is 31″.4, while the diameter of Venus under the same conditions is 9″.8. The former became morning star four days before the latter became evening star, and makes his appearance in the morning several weeks before his rival graces the west with her visible presence.

Jupiter is in conjunction with Mercury on the 20th at 2 h. 6 m. P. M., being 56′ north. The former a superior planet, and the latter an inferior planet, traveling in opposite directions, must meet on the celestial road when within certain limits. If one had eyes to pierce within the solar rays, an assemblage of planets would be found in near proximity to the great day star.. Jupiter and Mercury near together on his western, and Neptune and Venus on his eastern side.

The moon, the day before her change, is in conjunction with Jupiter on the 14th, at 9 h. 52 m. P. M., being 2° 20′ south.

The right ascension of Jupiter on the 1st is 2 h. 26 m., his declination is 13° 28′ north, his diameter is 31″.4, and he is in the constellation Aries.

Jupiter rises on the 1st at 4 h. 56 m. A. M. On the 31st, he rises at 3 h. 17 m. A. M.

MARS

is evening star. There is one thing to be said in his favor, and this is his high northern declination, always desirable in a planet's course. This would be more highly appreciated if he were in a different portion of his orbit. As he is practically invisible, his long stay above the horizon is of little avail, but, as in many terrestrial events, his time will come, when the most powerful telescopes will be turned upon his disk, with the possibility of learning something of this strange world, where clouds are few and sunshine reigns.

The moon, when three days old, is in conjunction with Mars on the 18th, at 5 h. 15 m. A. M., bing 3° 32′ north.

The right ascension of Mars on the 1st is 5 h. 25 m., his declination is 24° 20′ north, his diameter is 4″.5, and he is in the constellation Taurus.

Mars sets on the 1st at 10 h. 14 m. P.M. On the 31st, he sets at 9 h. 39 m. P. M.

MERCURY

is morning star. There is nothing of note in his course, as he makes his way from western elongation to superior conjunction, excepting his conjunction with Jupiter, already alluded to.

The moon, on the day before her change, is in conjunction with Mercury on the 14th, at 6 h. 56 m. A. M., being 3° 12′ north.

The right ascension of Mercury on the 1st is 0 h. 59 m., his declination is 3° 7′ north, his diameter is 7″.6, and he is in the constellation Pisces.

Mercury rises on the 1st at 4 h. 5 m. A. M. He rises on the 31st at 4 h. 12 m. A. M.

URANUS

is evening star. He is still in excellent position for observation as he retrogrades or moves westward. Observers who have located the seemingly small planet will find it an enjoyable study to follow his course and keep track of the slow-motioned wanderer until he disappears from view. He is in a region almost destitute of visible stars, Alpha Librae on the east being his nearest neighbor of any size. At the close of the month, he has retrograded into his old quarters in Virgo.

The moon is in conjunction with Uranus three days before the full, on the 27th, at 6 h. 44 m. P. M., being 1° 24′ south.

The right ascension of Uranus on the 1st is 14 h. 26 m., his declination is 13° 56′ south, his diameter is 3″.8, and he is in the constellation Libra.

Uranus sets on the 1st at 4 h. 55 m. A. M. On the 31st, he sets at 2 h. 54 m. A. M.

NEPTUNE

is evening star. He is very near the sun, and almost at his greatest distance from the earth. His conjunction with Venus has been described.

The moon, the day after her change, is in conjunction with Neptune on the 16th, at 6 h. 50 m. P. M., being 5° 5′ north.

The right ascension of Neptune on the 1st is 4 h. 34 m., his declination is 20° 28′ north, his diameter is 2″.6, and he is in the constellation Taurus.

Neptune sets on the 1st at 9 h. 5 m. P. M. On the 31st, he sets at 7 h. 17 m. P. M.

Venus, Mars, Saturn, Uranus and Neptune are evening stars at the close of the month. Jupiter and Mercury are morning stars.

Volcanic Activity at the Sandwich Islands.

Mr. S. D. Macdonald, F.G.S., of Halifax, N. S., who is wintering on those islands, writes as follows:

"The somewhat abrupt termination of what promised to be a violent eruption from the summit crater of Mauna Loa, after its usual period of quiet, places the people of Hawaii in a state of awful suspense, fearing, as they have every reason to from past experience, that an underground lava flow is in progress, and may, at any moment, burst forth beneath them. Several sharp earthquake shocks accompanied the eruption, which is always considered to be a premonition of a flow. There can be little doubt but that an outburst from somewhere along the dome of the mountain is impending."

This summit crater, known as Mokua-weo-weo, has an elevation of 14,000 feet, and from it have come most of the lava flows that have wrought such destruction on that island. Its gently rounded top or dome, viewed at short distance, affords not the faintest indication of the fires which slumber within, and which, when they do awaken, cause such terrible earthquakes and lava flows, the like of which are unknown elsewhere.

The crater of Kilauea or, more properly speaking, the pit or lake of fire on the flank of Mauna Loa, has been unusually active for some months past.

This vast pit or caldron is nine miles in circumference, with vertical walls, and a depth of from 400 to 1,100 feet, according to the rise and fall of its molten tide.

At present intense action is confined to its western portion.

Visitors and tourists who have witnessed it in magnificent action of late are enthusiastic in their description of its fiery fountains tossing their red-hot spray high in air.

Its gory surges sometimes rolling in low, curling waves, and again dashing like wind-driven surf against lava cliffs, which fall, remelt, and form new waves, to be borne onward again in its blood-red tide, while dreadful detonations and earth tremors add sublime terror to the awful scene.

In extent, grandeur and intensity of action, Kilauea is unrivaled among volcanoes.

Correspondence.

A Liquid Road Hardener Wanted.

To the Editor of the Scientific American:

I have an abiding faith in the inventors of America. Our State has just voted the amendment, good roads. Now we want the inventor to help us out, and he can own the earth.

We want a liquid that can be sprinkled on the roadbed from a tank, that will petrify the ground to a depth of four inches or more, that will not cost to exceed $5 per rod. The ingredients would have to vary, as the soil varies. You can see the possibility of such a thing, and it may be possible.

Union City, Mich., April 6, 1893. D. L. MERRILL.

Progress of Mineral Industries in Virginia.

To the Editor of the Scientific American:

For us it is a matter of glad tidings to see the flow of Northern and foreign capital continuing with increased vigor toward the development of Virginia minerals.

About new year I began prospecting on the Irwin farm, Goochland County, for mica and discovered very valuable deposits of "lepidolite" (silicate of aluminum, potassium, and lithium) and "phlogopite" (silicate of aluminum, potassium, and magnesium) in kaolin and quartz, the former closely resembling the ores of Zinnwald, in Saxony, and especially those of Moravia and some sections of the Presidency of Bengal, in Hindostan; while the latter is equal in size and far superior in quality to the famous specimens extracted in such vast profusion from the Laurentian limestones of North Burgess, England, and reach the unusual size of 20″ × 30″.

To demonstrate the wealth of these new discoveries, I used about $3,000 of Northern capital in prospecting, under an optional right to purchase between January 1 and March 25, 1893, and during that time produced from within sixty feet of the surface, in open cut, over $10,000 worth of lepidolite, phlogopite, and biotite. A Northern syndicate have purchased a tract of 1,500 acres near Irwin, at a cost of $120,000, and are now preparing to work it on an extensive scale with $250,000 capital, which is all fully subscribed, and to which I am consulting engineer.

Further up the James River, near West View, on the R. & A. R.R., on the Jayne & Case farm, I am bringing "to bank," from a depth of less than fifty feet, peculiarly fine specimens of "fuchsite" (silicate of aluminum, potassium, and about 6 per cent of chromic oxide), a bright green mica, such as is famous to Schwarzenstein in the Tyrol, and peculiarly adapted for grinding up for the manufacture of wall papers and other glittering decorations, such as Christmas cards, shop signs, theatrical purposes, and enormously demanded as a lubricant for rapidly revolving machinery.

Here also land has jumped in price from the wearisome old agricultural value of not more than $10 per acre up to $100, and in one case I know of $250 per acre.

Still further up the James and backward from it the use of hundreds of thousands of imported dollars is located, and the employment of vast sums of money, such as even the days of land booms in this country never paralleled, is going on with daily increasing strength, the money earning fabulous profits and dividends.

Mica, however, is not by any means the sole attraction and impetus to draw capital into mining here; for gold, cobalt, lead, graphite, and the generous family of hydrated silicates of magnesia are each and all taking a prominent part in our State's mineral progress.

JOHN N. ADAMS,
Civil and Mining Engineer.

Irwin and Richmond, Va.

Transportation of Frozen Fish.

Mr. John Wallace, a prominent fish shipper at Kalama, Wash., gives, in *Ice and Refrigeration*, some interesting facts in relation to the rail shipment of frozen fish, which may be of general value. As our readers well know, a large quantity of frozen salmon finds its way from the freezing plants at the fisheries to the East. In shipping the trade recognizes the fact that fish frozen solid will in part refrigerate themselves. They therefore pack them tightly in boxes and load into refrigerator cars. These cars are first reduced to as low a temperature as practicable, and then the floor is covered with several inches of *chilled* sawdust. The boxes of fish are then loaded in, leaving a space of several inches between the sides, ends, and top of the car, which also is filled with *cold* sawdust. Then the car is closed and sealed. No ice is placed in the tanks of the car, but it has been found by quite extensive experience that fish so packed for shipment reach their destination in perfect condition in reasonably warm weather without ice, and that, too, after a passage of fifteen to eighteen days. The saving effected is the first cost of the ice; then cost of freight on the ice, and also a gain of 1,500 pounds of fish in lieu of that much weight of ice, which by the practice of the N. P. road is allowed free.

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THE COLUMBUS CELEBRATION, NEW YORK.

The harbor of New York will, this week, be the scene of unusual and interesting festivities. In celebration of the four hundredth anniversary of the landing of Columbus in the new world, and as a fitting prelude to the opening of the World's Columbian Exposition, at Chicago, a grand naval parade will here take place, the leading naval powers of the world being worthily represented.

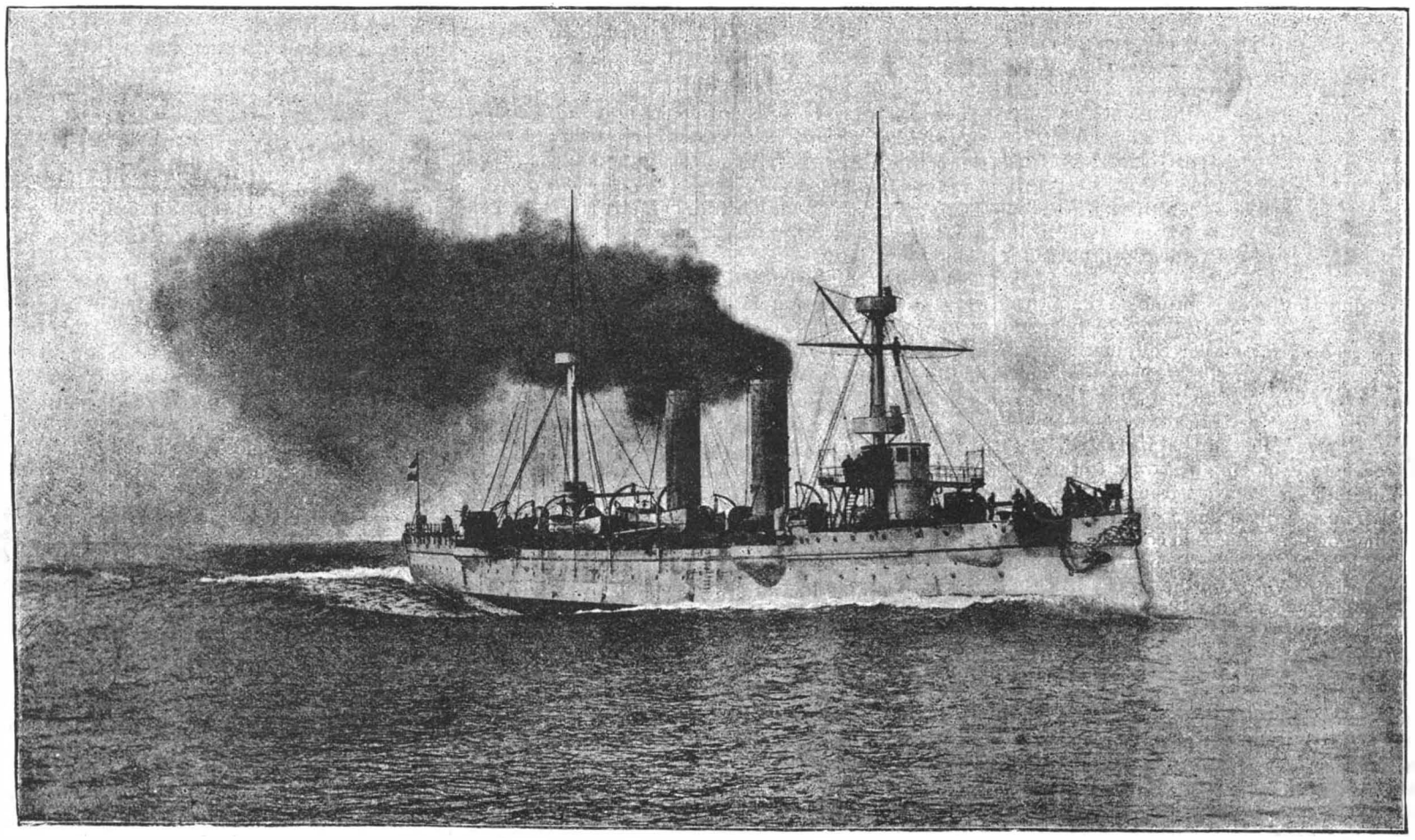
The magnificent waters of the Hudson River, which cover the heart of the great city on the west, form the anchorage for the great fleet, and here the ships, including the representative squadron of Columbus, deployed in two lines, will be reviewed by the President of the United States. This grand affair is appointed for the 27th inst. On the day following, the 28th, another most interesting festival takes place on shore. Detachments of marines and sailors from the various war ships will land and join in a grand procession, the line of march being from the Columbian statue, at Central Park, down Fifth Avenue, Washington Square and Broadway to the City Hall, where the Governor of the State will receive the distinguished guests. The following ships of war will take part in the great naval demonstration:

FOREIGN.—*English.*—Blake, Magicienne, Tartar, Australia; *Spanish.*—Reina Regenta, Infanta Isabel, Nueva Espana; *Russian.*—Dimitri Donskoi, General Admiral, Rynda; *German.*—Kaiserin Augusta, Seeadler; *French.*—Arethuse, Jean Bart, Hussard; *Italian.*—Etna, Dogali, Giovanni Bausan; *Netherlands.*—Van Speyk; *Argentine Republic.*—Nueve de Julio; *Brazil.*—Aquidaban, Tiradenta, and Republica. A few other representative vessels were also expected. AMERICAN.—Philadelphia, Newark, Baltimore, Bennington, Bancroft, San Francisco, Atlanta, Chicago, Yorktown, Vesuvius, Charleston, Concord, Cushing, Dolphin, and the monitor Miantonomoh.

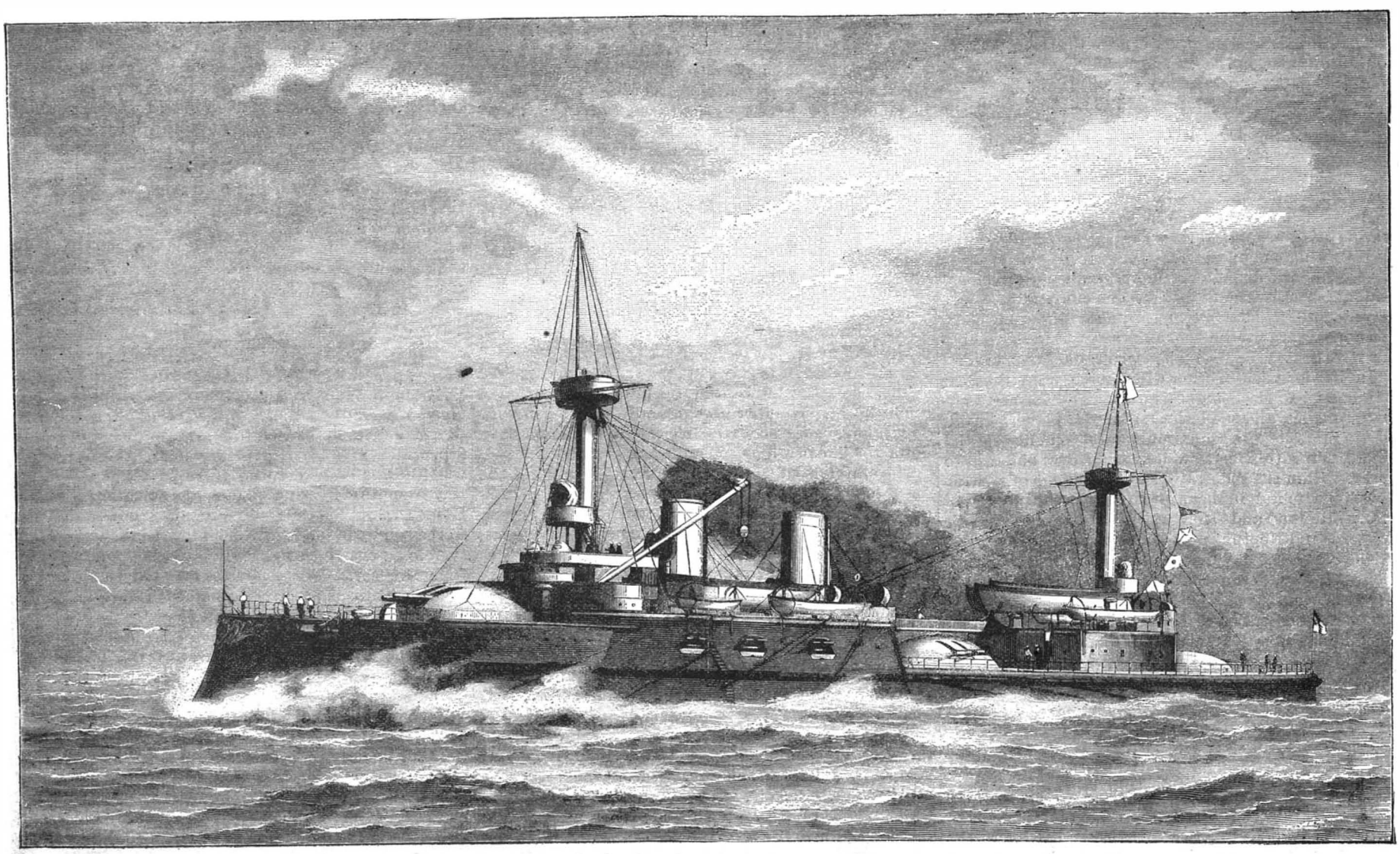
THE SQUADRON OF COLUMBUS.

Three vessels have been constructed, the exact counterparts of those which formed the original squadron of Columbus. One of these, representing the Santa Maria, Columbus' ship, was built by the Spanish government; the other two, the Nina and Pinta, were constructed in Spain, at the expense of the United States. From Huelva these vessels, convcyed by American war vessels, sailed over the original route taken by Columbus, to Havana, thence to Hampton Roads, and from there to New York, with the combined fleet of American and foreign ships, to take part in the naval festivities.

The *Revue Maritime Autrichienne*, of Pola, has recently published a very interesting article giving the result of all the investigations that have lately been made, particularly in Spain, for the purpose of ascertaining what was the exact type and maritime value of the three ships. The first of these, the Santa Maria,



THE ARGENTINE WAR SHIP EL NUEVE DE JULIO.



THE GERMAN WAR SHIP KURFURST FRIEDRICH WILHELM.

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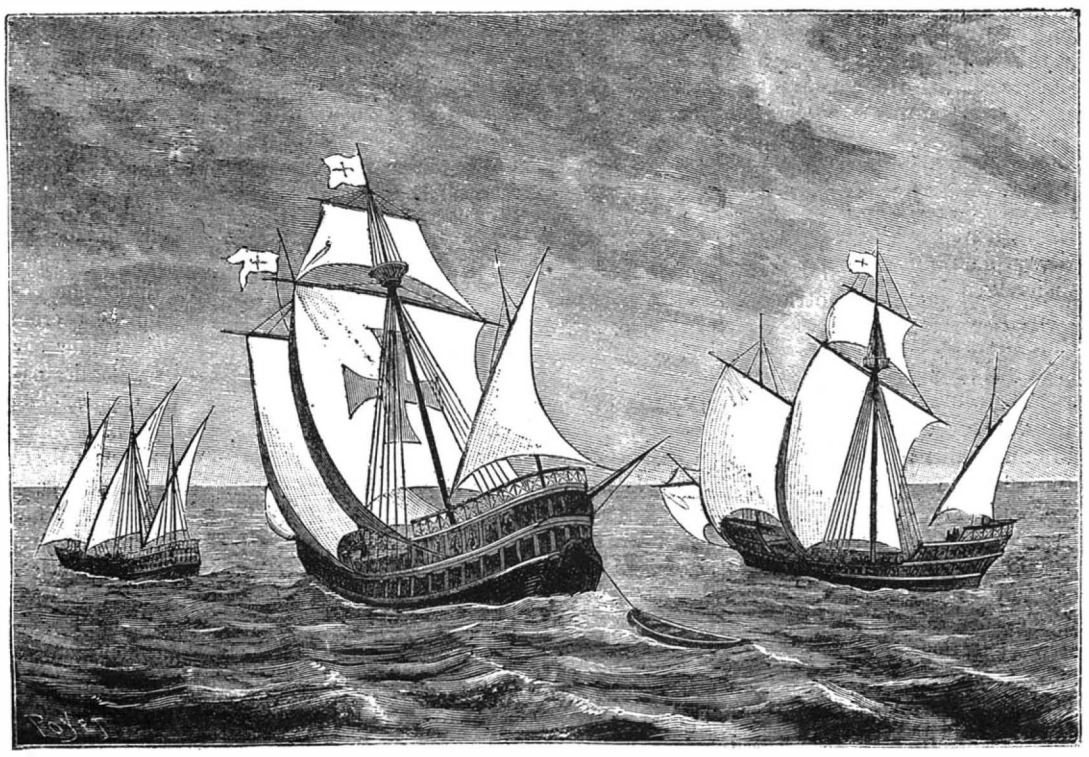
had the following dimensions: Length of keel, 62 feet; between perpendiculars, 75 feet; greatest width, 23 feet; depth, 14¾ feet; burden, from 120 to 130 tons. As the crew never exceeded ninety men, the ship was capable of carrying quite a large supply of food and water.

The suit of sails of the Santa Maria was that of a small three-masted vessel, with five sails only; a jib, foresail, mainsail, topsail, and a lateen. The general form of the hull was that of the round ships of the period. There was a large poop and a small forecastle. The freeboard was very low amidships, and the deck was here open.

The nautical qualities of the Santa Maria were excellent, as the admiral's log proves: "This ship behaved very well in bad weather, and had the speed of a good sailer."

The dimensions of the two other ships commanded by Columbus are not indicated. The sketches and the picture represent them as much smaller. The Nina resembled the Santa Maria. The Pinta carried lateen sails on her three masts, at least at the beginning of the voyage; but the admiral's log tells us that at the first stop (at the Canaries) this set of sails was replaced by square ones, in order that the ship might be placed in the same conditions as the two others. These three ships, sailing as consorts, flew the flag of Castile at the mainmast and that of the admiral at the mizzen. The first was divided into four squares, two red and two white. The latter each bore a lion and the others a castle. These were the arms of Castile. Those of Aragon were excluded by the orders of Queen Isabella, the government of that country having refused to participate in the expenses of the expedition. The admiral's flag was a white pennant with a green cross between two crowned letters F and I—the initials of the names of Ferdinand and Isabella, who had given these arms to Columbus. A cross was painted on the sails of the ships, according to the custom adopted by the Spanish and Portuguese, in order to distinguish their vessels from those of the infidels.



THE SQUADRON OF COLUMBUS—THE SANTA MARIA NINA AND PINTA.

In contrast to the ships of Columbus, and as showing the progress made in naval construction during the four centuries that have elapsed, we give plates of some of the modern war vessels. Three centuries elapsed after the discovery of the new world by Columbus before the discovery of steam navigation was made.

The very latest and probably the most perfect example of modern steam naval architecture is realized in the new Argentine war ship El Nueve de Julio, which figures to-day in the harbor of New York. We give an engraving from *Engineering*. She is regarded as the fastest war vessel afloat, and is one of the most powerful. She is 350 feet long, 44 feet broad, 16½ feet mean draught, displacement 3,500 tons, 14,500 indicated horse power; speed, 22 knots on 6 hours' run, 22·74 knots on mile run, being over 25 miles per hour.

Her machinery and magazines are below water line. She has sloping sides protected with steel 4½ inches thick.

THE RUSSIAN CRUISER PAMYAT AZOVA.

This ship, of which we give from the *Engineer* an illustration, is a vessel of 6,000 tons, with a speed of 18 knots; she is ship-rigged, Russia still regarding sails with favor. She has a 9 inch belt, but no horizontal armor; which the Russian naval authorities seem to have held in small account until last year. The Pamyat Azova was launched in 1887; she is 377 feet long by 50 feet beam, and is wood-sheathed over the armor belt. She mounts two 8 inch 13½ ton breech-loaders, and twelve 6 inch 6 ton breech-loaders, besides a dozen quick-fire guns of small caliber. She has three torpedo tubes; she can stow 1,000 tons of coal, and her twin screw engines will develop 11,500 horse power when pushed.

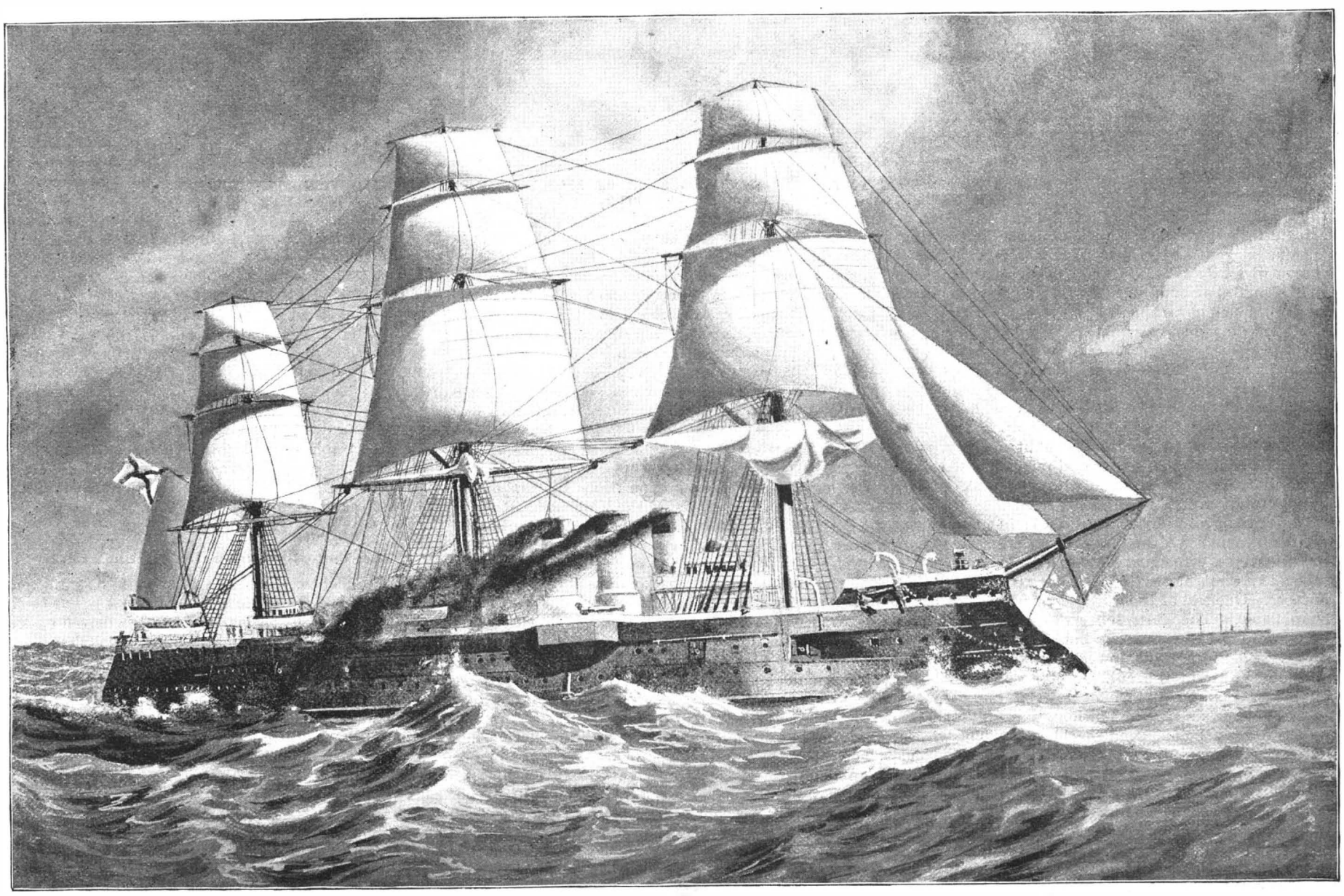
THE GERMAN WARSHIP KURFURST FRIEDRICH WILHELM.

Another of our engravings, which is from *Illustrirte Zeitung*, represents the Kurfurst Friedrich Wilhelm, which was launched at Wilhelmshafen, June 30, 1891. The following are the chief dimensions of this vessel: length, 396 feet; breadth, 64 feet; depth, 36 feet; displacement, with medium draught of 24 feet 6 inches, 10,000 tons. Two screws, having a diameter of 16 feet 8 inches, are driven by two three-cylinder compound engines, giving a speed of between fifteen and sixteen knots.

The Heathen Chinee.

A well-to-do wine grower from California, who is on a visit to the Eastern cities, declines to commit himself on the Chinese question—if there is a question. He says: "My personal dislike to the Chinese is as strong as anybody's, but that doesn't blind me to the fact that we Westerners would be nearly helpless without them.

"They have built our railroads, laid out our streets, hewn our wood, and drawn our water for us, and to-day we depend on them to run our farms and gardens, do our housework, and cook our food. They do for us what women servants do for you in the East. Besides, as between the Chinese and the men who direct hostilities against them in San Francisco, I prefer the Chinese."



THE RUSSIAN BELTED CRUISER PAMYAT AZOVA.

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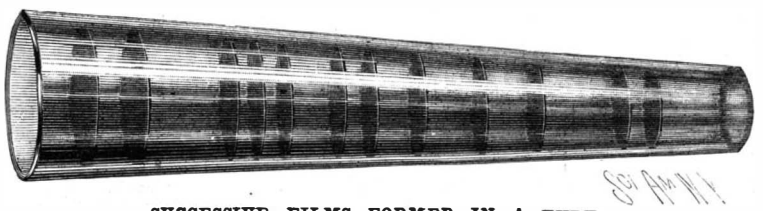
EXPERIMENTS WITH SOAP BUBBLES.

T. O'CONOR SLOANE, PH.D.

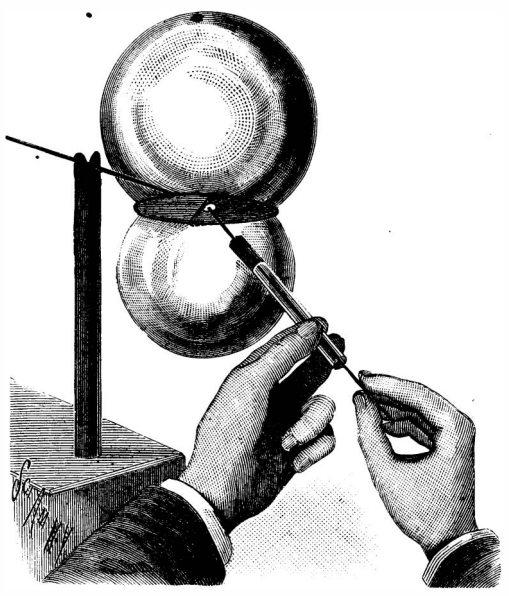
Soap bubbles afford so fascinating a subject for experiment that any notes on the subject are sure to prove of interest to many. In the experiments illustrated several properties of the film are shown. Its permanency and strength enable it to make the material for the sails or vanes of a wind mill. The mill wheel is constructed very readily with a bonnet pin as axle and a thin piece of wire fastened thereto, as shown, to determine the outline of the sails. This wire gives two loops, one on each side of the axle, which are then bent into a helical shape, as shown. A little stand is provided for it, as shown; the interior of the notches in which the pin rests may be smoothed by being touched with a hot wire. This carbonizes the wood and forms a better journal. To prepare it for use, the wheel is dipped into a cup of soap bubble solution and removed therefrom; this leaves the vanes filled with the film, which is forced to take a helical form. The pendent drop is touched off with a piece of paper and the wheel is placed in its journals. To make it rotate, the experimenter blows through a paper tube, a foot long and one or two inches in diameter, standing about six feet from the wheel and holding the tube about six inches from the mouth and pointing at the face of the wheel. If held directly against the mouth, the blast of air will not reach. If the wheel is being projected in a lantern, it should be placed with its plane of rotation oblique with the plane of condensers, so as to receive a good breeze. The wheel may thus be made to spin with very high velocity.

The fact that a film tends to be as small as possible is very elegantly shown by the use of a conical glass tube. By dipping its larger end deeply into the solution so as to wet the interior and withdrawing it, a film forms across its mouth. The film, tending to contract, travels toward the small end of the tube. A second film is picked up this time by a slight immersion of the end, and it also proceeds on its journey. In this way a number of films can be formed in the tube, all traveling from the large to the small end at the same rate.

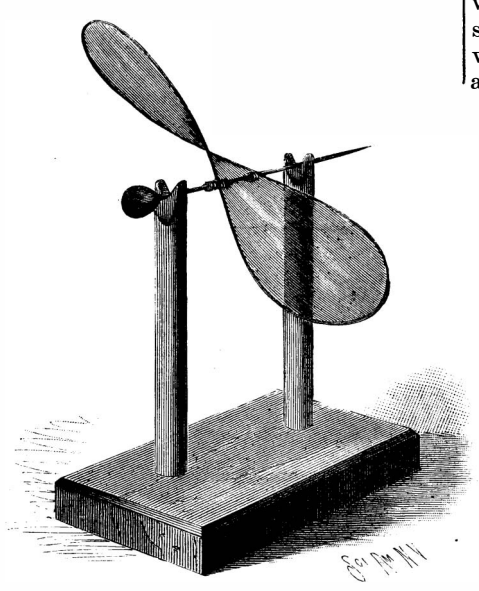


SUCCESSIVE FILMS FORMED IN A TUBE.

If a large and a small soap bubble are placed in communication with each other, the small one will always empty into the large one. This may be shown by a more or less complicated apparatus, involving the use of a bifurcated glass tube or its equivalent. In the cut a method of doing the same thing, far more elegant because simpler, is given. A closed ring of wire with a handle is supported on a stand; the ring should be about an inch and a half in diameter. Across its center a thin wire is stretched, with a very small loop made at its center, which loop should lie in the plane of the large ring. A soap bubble is blown, about 2 inches in diameter, and placed upon the previously moistened ring. The ring is then inverted and a second soap bubble, as nearly as possible of the same size as the other one, is placed upon the ring. The condition of things thus brought about is that there is a soap bubble above and one below the ring, while the ring itself is closed with a flat disk of soap bubble solution.



A SMALL BUBBLE EMPTYING INTO A LARGER ONE.



WINDMILL SAILS OF SOAP BUBBLE FILM.

SIMPLE DEVICE FOR BLOWING BUBBLES.

To bring the interiors of the bubble in communication with each other, the film within the small loop on the transverse wire must be broken. A short glass tube and a straight piece of wire are required for this purpose. One end of the wire is heated in a candle or lamp flame. The glass tube, which has previously been moistened with the soap bubble solution, is then thrust right through the lower bubble in about the position shown in the cut. As it goes through the bubble it picks up a film which closes it, and prevents the bubble from entering, although the film slowly travels toward the open end of the tube. The wire is now thrust through the glass tube and with it the film within the loop is touched, and the wire is at once withdrawn. The hot wire breaks the little film the instant it touches it. As quickly as possible the tube is also withdrawn or its open end is closed by the finger. Communication thus being established between the interiors of the bubble by the breaking of the film within the loop, at once the smaller bubble begins to empty itself into the large one, and, however small the loop is, in a few seconds the small bubble will completely disappear, and a single one containing the contents of both will be left. This is an exceedingly effective experiment, and it will be seen that the principle involved of breaking films within bubbles admits of many other experiments. Thus the entire film may be broken at once, producing a very rapid action. Three or four bubbles may be blown and stuck together and the films between them may be broken singly so as to aggregate all the bubbles into one. It is obvious that instead of the wire a thread loop may be used, and the standard experiments with thread loops may be performed with a film inside of soap bubbles.

For blowing the bubbles nothing is better than a simple bottle with doubly perforated cork fitted with two glass tubes. The tubes may be from one-eighth to one-quarter inch in internal diameter. Their shape and arrangement are clearly shown in the cut. The bottle catches the condensed moisture of the breath which otherwise would interfere with the success of the experiments. One great point to be observed in blowing a bubble is to start it with the mouth or opening of the pipe on which the bubble is formed perfectly horizontal.

Many formulæ more or less complicated have been published for soap bubble solutions. The following I have found to be very satisfactory: 1 part of caustic soda is dissolved in 320 parts of water; either rain water or distilled water should be used. To this is added 7 parts of pure oleic acid; the whole is agitated strongly until full combination has taken place. All the above parts are parts by weight. To 3 volumes of the above solution 1 volume of the purest glycerine is added and the whole thoroughly mixed by shaking. After standing a day or two, solid impurities float to the top; the clear solution may be siphoned from under them and is ready for use. It has sometimes seemed to the writer that it improves with time.

Bicycles versus Tricycles.

BY OBERLIN SMITH.

Pertinent to certain communications by "J." in the February 25th and "A. G." in the March 25th issues of the SCIENTIFIC AMERICAN, I wish to call attention to a very prevalent error in regard to the stability of tricycles when comparing them with bicycles. This error the writer once indulged in himself before he had learned to ride a bicycle and had found out with what perfect ease one of these machines will stay upright, apparently without a voluntary effort—that is when running. At first sight it seems ridiculous that a thing should stand upon two points instead of the proverbial three which we learned about in our school geometry. This, however, is not a case of *standing*, but of a combination of delicate motions.

The theory of the three points resting upon a plane, as applied to a tricycle, is all right, provided the machine is running upon a horizontal plane, as upon the floor of a rink or the center of an asphalt street. When, however, the conditions of the environment change, as, for instance, when one has to run upon the sloping part of a street near the curb, or upon a sloping sidewalk, or, what is very much worse, upon country roads where the wheel upon one side may be in a rut while the other is upon a hummock several inches higher, the tricycle is one of the most uncomfortable and "tricky" machines imaginable, and in the case of the country roads mentioned is not safe against upsetting sidewise—unless it is made very low and with the rear wheels three or four feet apart.

The beauty of a bicycle is that when the rider has once learned to keep it upright, this vertical position may be easily maintained, regardless of the side slope of the road, and, furthermore, the machine may pick its way in narrow and devious side paths, or along little gullies, or along the ridges of little hills, with no more difficulty than upon level ground. The tricycle, upon the contrary, immediately begins to tip sidewise, under the conditions named, much to the alarm of the rider. The result (on rough roads or on any side slope) is a constant nervous fear which makes the use of these machines anything but joyous. The difficulty in question would be very much increased with a narrow machine with the "two rear wheels about five or six inches apart," as proposed by the correspondent, "J." In such case a very slight difference of level sidewise would tip the machine at a considerable angle, so that it would be extremely difficult to prevent tipping over, while a bicycle under the same circumstances would stay perfectly upright.

When a "cycle" turns a rather sharp curve, even if the ground is level, the difference in favor of the bicycle is again very marked, as it can lean inward naturally to counteract its centrifugal force, while with the tricycle there is a decided sensation in the rider's mind that he is about to be thrown over outwardly. One of the principles involved in the vertical position which the bicycle maintains (except upon curves) is that the combined center of gravity of the machine and of the rider keeps its path in a vertical plane, while with the tricycle this is impossible, unless the roadway is exactly horizontal sidewise, or unless one of the wheels leaves the ground entirely. As, however, both wheels are supposed to stay upon the ground, the consequence is that the center of gravity travels in a line which is wavy in a sidewise direction, the result being anything but pleasant for the rider or conducive to safety and high speed.

To sum up the question, and assuming that the road to be run upon is reasonably flat and smooth, a tricycle is a useful and pleasant vehicle for old people, invalids, and others who do not wish to learn or practice anything like acrobatic work. It also has the considerable advantage that it may be run very slowly or stopped entirely without the rider leaving his seat. Its principal disadvantage, even under the roadway circumstances mentioned, is of course the extra weight which has to be transported—as for carrying a given load it is not possible to make a tricycle as light as a bicycle. Furthermore, considering the fact that our available roads are only reasonably flat and smooth, and the further fact that curves must sometimes be followed, all tricycles should have their centers of gravity as low as possible, and their wheels wide apart sidewise. Under conditions varying from those just given, a bicycle is by far the most practicable and pleasant vehicle, not only on account of its comparative cheapness, lightness, and high speed, but on account of its superior adaptability to all kinds and conditions of roads.

The Connelly Car Motor in England.

For the past two months a portion of the traffic on the London and Greenwich tramway system has been regularly worked by a small locomotive driven by oil vapor. This is the Connelly motor, which has had successful use on tramways in the United States for some time. The portion of line assigned to it on the Greenwich route is five-eighths of a mile in length, beginning just beyond the South Bermondsey Railway Station. The engine is fixed in a small car, and is capable of developing 12 horse power on the brake. From a return of seven days working—14 hours a day—it appears that 350 trips were made, covering 507·85 miles and carrying 4,182 passengers, with a total consumption of 70 gallons of oil. The engine works most satisfactorily, taking gradients and sharp curves well, maintaining the Board of Trade regulation speed of 8 miles an hour easily, and being evidently capable of a far higher speed.

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RECENTLY PATENTED INVENTIONS.

Engineering.

ROTARY ENGINE.—James C. Walker, Waco, Tex. This engine has a steam drum rotated by steam passing out through arms discharging into annular chambers rotating about the drum in a reverse direction, the arms carrying pistons which travel in the annular chambers, valves and steam spaces being arranged to deflect the steam and impart a rotary motion to the annular charges, as the steam is discharged from the drum. Two distinct rotary motions in reverse directions are obtained, and peculiarly arranged cut-off devices are provided, the discharge of the steam being automatically controlled.

Railway Appliances.

SLEEPER BLOCK.—Reuben D. Culver, Veedersburg, Ind. Sleeper blocks, preferably made of terra cotta, and with a broad, flat base and tapering sides, have side shoulders in which extend longitudinal rods connected by securing bolts to the base of the rail. The bases of the rails are shaped to conform to the beveled tops of the sleeper blocks, and the blocks and the rails are connected by cross tie rods. The blocks are arranged in trenches and rest upon a solid foundation, to afford a permanent and level seat.

RAILROAD GATE.—Wm. J. O'Beirne, Brooklyn, N. Y. This invention is especially for elevated railroads, the gate provided being designed to close the platform to the track and train until the latter is at a standstill. One long gate, moving easily on friction rollers, is held on the edge of the station platform, and this gate has openings at distances apart adapted to register with the platforms of the several cars, these openings being closed by auxiliary gates. By turning one hand wheel the operator moves the several gate openings to the proper place when the train stops, and by turning another hand wheel the several gate openings are simultaneously opened and closed.

Electrical.

ALARM CLOCK.—Thomas P. Adams, Rico, Cal. An attachment for an ordinary alarm clock is provided by this invention, by means of which an alarm may be given by an electric battery and bell, the alarm to continue until the circuit is broken. A case containing the battery has on its upper side two contact plates and an insulating piece, upon which rests an ordinary metallic clock, the alarm being connected with the plates. A circuit maker is adapted to be held elevated by the winding arbor of the alarm, and when released it descends upon the other contact plate and electrically connects the two plates through the medium of the clock case.

Mechanical.

MORTISING MACHINE.—Christian Loetscher, Dubuque, Iowa. A tilting frame is mounted to turn on the bed plate frame, a bed plate being held laterally adjustable on the tilting frame, while a clamping plate sliding on the bed plate has a rod, the axis of which forms the center of the tilting frame. The invention is an improvement in chain tool mortising machines. After the machine is once started no further attention is required, the several mechanisms being actuated automatically and the operator only needing to remove the material to be treated or shift it on the bed plate to bring it in proper position for the mortising tool.

FLOOR CLAMP.—Geo. O. Woolcocks, Brooklyn, N. Y. The head of this tool has slotted arms, between which fits a toe piece having parallel arms and spurs, there being a cam lever between the arms of the toe piece, while a pin passing through the arms of the toe piece and cam lever projects into the slots of the arms of the head. This clamp is light, strong, and inexpensive, takes up but little room, and may be quickly applied to the boards of a floor, wall, or ceiling, to force them firmly together and hold them in position until they are thoroughly fastened.

STAIR BEVELING INSTRUMENT.—John A. Caldwell, Vancouver, Canada. This is an improvement on a former patented invention of the same inventor, for an instrument for describing stair curves. The invention consists of blades having slotted transverse guideways, sleeves engaging the compass legs being held transversely adjustable in the guideways, the sleeves being also mounted to turn in the guideways. The improved instrument is simple and durable in construction, and adapted to be readily and conveniently adjusted and manipulated for drawing the desired lines.

Agricultural.

WHEEL PLOW.—Abraham Dalke and Gustav Wiens, Henderson, Neb. This invention provides an improvement in gang plows whose frames are adjustable vertically by means of cranked axles, that the plows may be made to run at different depths in the soil, or readily moved from place to place. Three plows are rigidly secured to the frame, on a line diagonal to the line of draught, and the rear one only has a landside, a forward wheel on a front laterally bent axle rendering landsides unnecessary on the two front plows. The main axle is rocked, and the plows raised or lowered by a hand lever within convenient reach of the driver, and having a spring-pressed dog for locking it to a notched fixed segment.

TRANSPLANTER.—Daniel Clow, Janesville, Wis. This invention relates more particularly to an improved tobacco transplanting device, providing an apparatus adapted to carry a supply of water, and means for intermittently discharging a definite quantity upon each plant as it is placed in the ground. A vertically adjustable frame regulates the depth of the furrow, the discharge of water upon the plant is controlled by a regulating valve, and an adjustable feeder's seat carries the rollers which press the dirt with the desired pressure around the plant.

Miscellaneous.

WATER PURIFYING PROCESS.—Alfred Dervaux, Brussels, Belgium. This invention provides a method of charging water with lime, the latter being delivered to an upwardly flowing column of water below its outlet, the charged liquid being decanted at a point above while the undissolved lime gravitates toward the inflowing water, and is prevented from flowing out with the charged liquid, affording a continuous production of milk of lime. A saturating apparatus based on the same principle is employed for preparing solutions of soda, barium, or other readily soluble reagents.

TREATING GOLD AND SILVER ORES.—George W. McGee, 531 Sacramento Avenue, Chicago, Ill. According to the process provided by this invention, the crushed ore is submerged in a solution of caustic soda or potash, the mixture is heated and to it are added salts of oxalic acid and sulphate of copper or bluestone, the liquid being then evaporated from the mixture. The process is simple and comparatively inexpensive, and is designed to render refractory and other ores free milling, preventing the gold or silver from volatilizing during the process of reduction.

PARACHUTE PROPELLER.—Elijah Nyswanger, Hanford, Cal. Two scoop-shaped paddles are pivoted oppositely on a reciprocating frame or carrier, and arranged with their concave sides inward, with means for throwing the paddles alternately into operative position inclined to each other to form a conical pocket, and into inoperative position or parallel to each other, there being a crank connection between the hinged paddles and crosshead rods. The hinged paddles or wings open to offer resistence to the air or water when pulled in one direction, and when pulled in the opposite direction, they tilt into position to move with little resistance. The propeller is adapted for use on vessels in the water or on air ships.

SPRING HINGE.—Herman Reichwein, Villa Park, N. J. An improvement simplifying the construction of double-acting hinges has been made by this inventor, the new hinge having but few parts, and designed to be perfect in action, durable, and quickly applied. It has a stationary and a swinging section, the latter having a rocking movement upon the other at their inner faces, while a pintle with two transversely connected vertical members is mounted in the sections, and a spring between one hinge section and its vertical member, the spring being in a suitable barrel or casing.

UMBRELLA NOTCH AND RIB.—Harry L. Heck and William S. Kellogg, Little Rock, Ark. The body of the notch has a flange with rib sockets, and a recess above the flange adjacent to which is a spring, a cap having an aperture to receive the spring when the cap is forced upon the body, the two sections being readily disconnected by forcing the springs inward. A device is also provided for attaching the cover to the ribs at a point intermediate of their lengths, and it consists of a wire bent upon itself to form an eye or loop at the top of the rib, to which the cover is stitched. The wire is carried down on opposite sides of the rib, and bent upward into its hollow U-shaped portion, where it is extended longitudinally.

MATCH BOX.—Housatonic Brass Company, Wallingford, Conn. The hinged cover of this box is adapted to receive and hold by frictional engagement a removable cap or casing constituting a separate chamber for the reception of dice, etc., the cup or casing being adapted for use as a dice box when taken out of the cover.

HORSE DETACHING DEVICE.—Charles E. Harris, Brandon, Cal. A lever pivoted on the breast collar is connected with the traces, a casing supported from the harness saddle being also connected with the traces, the casings being fastened to the shafts or poles by a locking device in which the locking latches are engaged by tripping levers upon the pulling of a wire by the occupants of the vehicle, the casings then sliding over the thills on the further forward motion of the animal. The animal is very quickly attached to the vehicle where this improvement is employed, and may be instantly released from the vehicle in case of accident or a runaway.

BIT BRACE.—John E. Hitch, Wilmington, Ohio. This brace has an adjustable sweep, that the brace may be readily adapted to a large or small boring bit, or for boring in contracted spaces. The horizontal portions of the sweep are in two sections, the outer section, on which is the handle, being so jointed to the inner arms that it may be extended out at full length from the bit, or adjusted so that the handle will be nearly up to the vertical line of the bit.

GATE POST.—Joseph W. Barnes, Mauzy, Ind. This gate has a base consisting of two parallel beams and connecting braces, the metal post passing through one of the beams, and having at its lower end a foot packed by the ground. Brace rods connect the upper end of the post with the outer beam, and collars vertically adjustable on the post form seats for the eyes of the gate. The post is strong and readily set up, permits the full opening of the gate, and allows for its adjustment at any desired height from the ground.

FAN ATTACHMENT FOR CHAIRS.—Anton Flierboom, Elizabeth, N. J. A foot rest adapted to serve as a treadle is held in arms pivoted near the bottom of the front legs of the chair, and there is a crank and pitman connection between the treadle foot rest and a shaft journaled under the seat, this shaft being connected by a belt with a vertical shaft at the chair back, on the upper end of which is held a fan wheel. A pitman from the crank is also connected with a bellows, so arranged that when the fan wheel is rotated the bellows will direct a current of air upon the feet and legs of one rocking in the chair.

WASHING MACHINE.—Ernest W. Gerbracht, Brooklyn, N. Y. This is a machine for scouring or cleaning filter press cloth, blankets, bags, etc., and the cleansing material is held in a sluiceway over which passes a carrier with the fabrics, the scouring devices acting in the presence of the cleaning compound, and the material during the process being made to travel in a direction to carry the cleansed portion away from the cleansing material. The operation of the brushes is automatic, and the adjustable and traveling carriers have automatic clamps to hold blankets or cloths of different thicknesses.

WASHING MACHINE.—Frank J. and Mead C. Coon, Walla Walla, Washington. Mounted centrally on spiral springs, so as to be easily rocked, is a suds box having a flat bottom and straight sides and ends, and inclined end shelves extend toward the center and bottom of the box to form pockets with contracted mouths. As the box is rocked, and the water and clothes thrown alternately from one side to the other, the air in the pockets is compressed and released, and the air and water are forced through the clothes in alternately opposite directions.

CLOTHES DRIER.—Thomas Fry, Calgary, Canada. This is an improvement in clothes horses or racks, and consists of a suspensory device which may be readily attached to or detached from a socket secured to the ceiling or other overhead support. It is of simple construction, the rack being readily lengthened or shortened and revolved in its socket as desired, while the arms which receive the clothes may be easily disconnected from the body of the rack, enabling the device when not in use to be placed in a small compass.

FLAT-IRON HOLDER.—Carl C. Moritz and Stephen D. Greenwood, Salt Lake City, Utah Ter. This holder is made in two hinged sections, adapted to be quickly closed upon the handle of a flat iron, no matter what the diameter of the handle may be. The fingers of the hand are also protected from the heat of the iron by a fender or guard held beneath the handle, both the holder and the guard having an asbestos-coated surface where they come in contact with the heated iron.

JAR CLOSURE.—Frank. H. Palmer, Brooklyn, N. Y. This improvement provides for securely fastening a jar cover in place to prevent leakage, and also to prevent fruit or other solid contents from being exposed to the air above the liquid in the jar. The solid contents are held down by a cover plate having projections extending into the upper end of the jar, and the latter is formed with an exterior flange having a double bevel, while the cover has a bail with downwardly extending arms having inwardly bent lugs abutting on the lower bevel, and adapted to engage the bottom of the flange when the bail is pressed.

Designs.

BRUSH OR MIRROR BACK.—Austin F. Jackson, Taunton, Mass. This design embodies floral sprays introduced inside of beads around the edges, in combination with convoluted scrolls and ribbon-like representations.

MEDAL.—Cesar Orsini, Rome, Italy. The obverse side of this medal has medallions representing Columbus and Washington, with an eagle spreading its wings above and holding an olive branch in its talons beneath. The reverse has a heroic figure of Liberty gazing at a cross apparently displayed in the sky over the grounds of the Columbian Exposition.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

A MANUAL OF MACHINE DRAWING AND DESIGN. By David Allan Low and Alfred William Bevis. London: Longmans, Green & Co. 1893. All rights reserved. Pp. vii, 375. Price $2.50.

The title of this work explains very fully its scope. It covers the mechanical drawing of all kinds of machinery, including boilers. A large number of illustrations, all in line work, are given to elucidate more thoroughly the subject. Some general principles of mechanics and notes on mechanical drawing precede the main volume of the work. It will be found a thoroughly meritorious contribution to the literature of the draughtsman's art.

THE MANUFACTURERS OF THE UNITED STATES. A classified and complete reference book for buyers and sellers for domestic and foreign trade. 1892. New York: The Manufacturers' Publishing Co. Pp. 1,500. Price $10.

This work may be divided into three parts. The first is an index of articles. This is most exhaustive, covering about eighty three-column pages of fine print. These pages are numbered. After them comes the second and principal part of the work. This is the list of manufacturers of and dealers in the articles named. It is arranged in alphabetical order, referred to the articles. Under each one are given the names of the firms or houses handling the article. To this part pages 1 to 991 are devoted. The third part is devoted to the larger industries, some eighty-three heads being given and pages 1500 to 1817 being given to them. From page 991 to 1500 there is a break in the numbering, the design being to allow for the insertion of extra pages. The exceedingly systematic arrangement of parts and the exhaustive indexing make this a very valuable and acceptable book.

TELEPHONE LINES AND THEIR PROPERTIES. By William J. Hopkins. New York: Longmans, Green & Co. 1893. Pp. xvi, 258. Price $1.50. No index.

The extension of telephony is well shown in the publishing of this work, devoted entirely to what may be termed telephone engineering. Underground and overground work, long-distance lines, properties of wire, insulators, exchanges, switchboards, interferences from outside sources and similar topics form the body of the work. It will be found an excellent contribution to the literature of electricity. It is very greatly to be regretted that no index is contained, an omission which is very severely felt, especially in scientific books.

SWITCH LAYOUTS. By Augustus Torrey. New York: Published by the *Railroad Gazette*. 1893. Pp. 191. Price $1.

This pocket book contains over a hundred representations of methods of laying frogs and switches on railroad tracks. The numerous plates are all put together and followed by the subject of curve easements, with numerous tables relating to the determination of curves for railroad lines. The work is bound in a cover adapted to the pocket and its whole aspect is one of a field book which will be in constant use by the practical engineer.

CONTRIBUTIONS FROM THE LICK OBSERVATORY. No. 3. Terrestrial atmospheric absorption of the photographic rays of light. By J. M. Schaeberle. Sacramento: State Office, A. J. Johnstone, Superintendent State Printing. 1893. Pp. 89.

From the Lick Observatory this monograph is sent us. It will be found of special value in these days of photographic astronomy, and its technical value will be certainly very widely recognized by astronomers.

INDIANA. DEPARTMENT OF GEOLOGY AND NATURAL RESOURCES. Seventeenth annual report. S. S. Corby, State Geologist. 1891. Indianapolis: W. B. Burford, contractor for State printing and binding. 1892. Pp. 705. 22 plates.

THE COSMIC ETHER AND ITS PROBLEMS. A scientific sketch. By B. B. Lewis. Bridgeport, Conn.: The *Evening Post* Print. 1893. Pp. vii, 159. Price $1.

ANNALS OF BRITISH GEOLOGY. 1891. By J. F. Blake. With six plates. London: Dulau & Co. 1892. Pp. x, 404.

This excellent work will be seen from its title to be a *sine qua non* for working geologists. It contains an abstract of a very large number of papers on geology, mineralogy, lithology, and allied topics.

FIRST REPORT OF THE STATE ZOOLOGIST, ACCOMPANIED WITH NOTES ON THE BIRDS OF MINNESOTA. By Dr. P. L. Hatch. Henry F. Nachtrieb, State Geologist. Minneapolis: Harrison & Smith, printers. 1892. Pp. 487.

☞ Any of the above books may be purchased through this office. Send for new book catalogue just published. MUNN & Co., 361 Broadway, New York.

SCIENTIFIC AMERICAN BUILDING EDITION.

APRIL, 1893, NUMBER.—(No. 90.)

TABLE OF CONTENTS.

1. Elegant plate in colors, showing an attractive cottage at Villa Park, Mt. Vernon, N. Y. Floor plans and perspective elevations. Cost $4,500 complete. Mr. Walter Stickels, architect, Mt. Vernon, N. Y.
2. Plate in colors showing the handsome Queen Anne residence of the Hon. Craig A. March, at Plainfield, N. J. Two perspective views and floor plans. Mr. Chas. H. Smith, architect, New York. An excellent design.
3. A dwelling near Longwood, Mass., erected at a cost of $5,200 complete. Perspective views and floor plans. A model design.
4. A dwelling at Chester Hill, Mt. Vernon, N. Y., erected at a cost of $4,750 complete. Floor plans, perspective view, etc. Mr. W. H. Symonds, architect, New York.
5. Engraving and floor plans of a residence at Oakwood, Staten Island, N. Y., erected at a cost of $3,540 complete. Mr. W. H. Mersereau, architect, New York.
6. A stable erected at Bridgeport, Conn. A unique design.
7. A residence at Wayne, Pa. A very picturesque design, treated in the Queen Anne and Colonial styles. perspective elevation and floor plans. Cost, $6,250 complete. Messrs. F. L. & W. L. Price, architects, Philadelphia.
8. Engraving and floor plans of a Queen Anne residence at Newton Highlands, Mass. Cost, $6,000. Messrs. Rand & Taylor, architects, Boston.
9. A square-rigged house, recently erected at Allston, Mass. Cost, $2,600. Plans and perspective elevation. Mr. A. W. Pease, architect, Boston, Mass.
10. The Fifth Avenue Theater, New York. View of the main front, showing the terra cotta decorations; also view showing the iron framework, erected by the Riverside Bridge and Iron Co., and a view showing the fireproof arching, erected by the Guastavino Fireproof Construction Co.
11. Sketch of a dining-room fireplace.
12. Miscellaneous contents: An improved woodworking machine, illustrated.—A new edge moulding or shaping machine, illustrated.—The box industry.—Natural gas at Geneva, N. Y.—Plaster of Paris floors.—Inside sliding window blinds and screens, illustrated.—City pavements.—The Alberene laundry tub, illustrated.—The "Murray" phaeton, illustrated.—An elegant bath tub, illustrated.—To thaw out frozen pipes.—Improved plane irons, illustrated.

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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Minerals sent for examination should be distinctly marked or labeled.

(4940) H. L. L.—We would not advise you to try the experiment of driving your boat with a primary battery. You might do it with storage batteries, but we think you would get more satisfaction out of steam than from anything else. For 2 horse power you will want 16 large cells of plunge battery. These would be very troublesome and somewhat expensive to maintain. It will cost you probably not less than $3 a day in addition to the labor required to take care of them.

(4941) A. C. F., Cal., writes: With a water pressure of 20 pounds per square inch, what is the horse power of a water wheel whose diameter is 12 inches, two jets being used whose outlets measure three-sixteenths inch respectively? Please give rule for finding horse power of this wheel. If above wheel were 18 inches in diameter, would it have more power? Will above wheel, with pressure named, run hand dynamo illustrated in SCIENTIFIC AMERICAN SUPPLEMENT, No. 161, at the rate of 2,400 revolutions per minute (I mean 12 inch wheel)? A. The 12 inch wheel with good buckets, like the Pelton wheel, with the pressure named, should run 500 revolutions per minute and be equal to four-tenths of a horse power, consuming 6 cubic feet of water per minute, and will run the dynamo. The 18 inch wheel will run 340 revolutions per minute and give you three-fourths horse power, using 10 cubic feet of water per minute. The 18 inch wheel will have no more power than the 12 inch with the same amount of water. Address the Pelton Water Wheel Company, San Francisco, for their catalogue of water wheels, from which you may obtain the power value under the varying conditions. The rule requires more explanation than we can give in Notes and Queries.

(4942) C. W. M. asks: Can you tell me how I can drill holes in glass, common window glass? A. The drilling of glass can be done with a hard drill and spirits of turpentine. A diamond drill is much better and cheaper, if there are many holes to drill.

(4943) M. B. B. asks: If a ball be dropped into a hole that passes clear through the earth, would it stop when it reaches the center or pass by it? I hold that the ball would stop, and I wish to settle an argument. A. The ball would have a hard rub in getting down to the center at all. Its circumferential velocity, derived from the earth's motion on its axis, would keep it against the east side of the hole, unless the hole was through the polar axis of the earth, when it might bob back and forth for a time until friction settled it at the center.

(4944) F. S. asks: 1. Is there any heat produced by the friction or motion of water? Is the temperature the same at the foot of Niagara Falls as in the river above? A. The agitation of water produces heat by friction, as demonstrated by Rumford and by experiments with screw propellers in a tank of water. Theoretically, the water in the pool should be slightly warmer than above the falls by friction, probably not within the means of observation. 2. Is there a reasonable probability that aluminum, in the near future, can be produced so cheaply as to come into practical use for roofing and other building purposes? A. There is no reasonable probability of aluminum becoming as cheap as tinned iron, zinc, or even copper for ordinary uses for some time yet, although its lightness now makes it about twice the price of copper per bulk.

(4945) W. B. H. asks: Will you please give me the processes for preparing chemically pure zinc and lead from the ordinary commercial metals? A. Zinc can be purified by simple distillation. This will remove most of the impurities. For the production of chemically pure lead the following process is given. As it is very complicated, probably your best plan will be to buy test lead as provided for assayers. This is almost chemically pure. Heat solution of lead acetate in a lead vessel with sheet lead at from 40° to 50° C. Filter and precipitate with dilute sulphuric acid. Treat the lead sulphate with a solution of ammonium carbonate and ammonia; this gives lead carbonate. A portion of the carbonate is heated in a platinum vessel just enough to give lead oxide. To the rest add dilute nitric acid, enough to dissolve part of the carbonate. To the boiling solution of lead nitrate thus produced the oxide is added, and the filtered solution is poured into a solution of pure ammonium carbonate. Fuse the precipitated carbonate with potassium cyanide, and fuse the metal thus produced again with potassium cyanide.

(4946) M. V. C. writes: Please inform how and what I will use to recast (scrap) Britannia metal so that it will have the same qualities as it has originally. That is its color and other properties. A. There is considerable variation in the composition of Britannia for various uses, and for the various parts of the same article. The alloy mostly used is composed of tin 15 pounds, antimony 1 pound, copper 3-10 of a pound. The solder on the work may be pure tin or a mixture of tin, lead or bismuth. Melt the metal in a kettle covered with pulverized charcoal. Add from 5 to 10 per cent of tin to make the metal cast clear.

(4947) G. S. asks how are guitars finished or varnished? What kind of varnish is used? A. The wood of guitars is finished as finely as possible with the finest sand paper; then rubbed with varnish on a piece of white woolen cloth, to fill the pores, leaving as little varnish on the surface as possible. When dry, rub down the surface to smoothness with the old sand paper that had been used; then varnish with a thin coat, using a flat camel's hair brush. Make the varnish with gum mastic 1 ounce, gum sandarac ½ ounce, gum camphor ¼ ounce, 95 per cent alcohol 2 fluid ounces; place in a clean bottle and dissolve, occasionally shaking up, then let it settle and decant for use. See next query also.

(4948) L. C. R. says: Please give me a recipe for varnish used on violins. A. The famous Italian violin makers used, it is said, the following sort of varnish on their instruments: Rectified alcohol ½ gallon, 6 ounces gum sandarac, 3 ounces gum mastic and ½ pint turpentine varnish. The above ingredients are put into a tin can by the stove and frequently shaken until the whole is well dissolved. It is finally strained and kept for use. If upon application it is seen to be too thick, thin with an addition of more turpentine varnish. The wood should be stained before applying the varnish. For a red stain use camwood, logwood, or aniline.

(4949) W. T. M. asks: What is the H. P. of the electric motors used on street cars? And how can you figure the pressure of a boiler with common arithmetic? *E. g.* you put 1 cubic foot of water in a tube and evaporate it; the volume of the tube being 5 cubic feet, what will be the pressure of the steam in the tube; and if the volume of the cylinder of the engine is 30 cubic inches, 200 revolutions, how many additional cubic inches of water must be evaporated per hour to sustain this pressure? A. Street cars require from 7 to 10 horse power for driving them. The volume of a cubic foot of water at 39° converted into vapor is 1641 cubic feet at atmospheric pressure. One cubic foot of water converted into steam in a tube or boiler containing 5 cubic feet of space from 39° of temperature will have a pressure of about 5,000 pounds per square inch and temperature of about 750° or a low red heat. The water required to run the engine under the condition stated will be 1,440,000 cubic inches per hour.

(4950) F. N. A. asks: 1. To what distance will the Bell telephone serve as a transmitter? A. Four or five miles on a good clear line. 2. Will a telephone work enough better to pay for using two wires? A. Yes. 3. What good transmitters are on the market now, for long distance, and where attainable? A. None are for sale so far as we know.

(4951) L. J. asks: 1. Can you tell me the composition used in making the wax cylinders of the Edison phonograph? How many threads to the inch is used as a feed for same? What is the diameter of the brass drum for holding cylinders? A. The composition of the wax cylinders of the phonograph is a secret. We know of no way to procure the formula for you. We believe the number of threads to the inch on the Edison phonograph is 100. The brass drum is about 2 inches in diameter.

(4952) E. H. O. writes: The water supply for a village is obtained from an "infiltration well" located close by the banks of a tidal river. There is an abundance of excellent water from the well for ordinary daily domestic consumption. We desire to have an auxiliary supply in case of fire, by running a pipe direct to the river and pumping therefrom. We have consulted hydraulic engineers, and they differ in opinion. Now I would like to ask you, if we run this pipe from the bottom of the well to low water mark in the river, will the water flow into the well from the river, or will the reverse be the result and we lose our present supply by the water flowing from the well into the river? It is upon this point that the engineers differ. A. If the water in the well at ordinary height is higher than the water in the river, it will flow to the river; if lower, the river will flow to the well. It requires but little engineering to ascertain the exact conditions. Better make a direct connection from the river to the pump, with valves to control the suction from both directions.

(4953) W. H. H. asks: How is the beautiful polish produced on the stocks of high grade guns? A. The stocks after finishing with the finest sand paper are varnished with pure shellac dissolved in 95 per cent alcohol, dried, and rubbed down fine with the old sand paper. Another coat of shellac is given. Then rub with French polish or shellac and mastic equal parts in alcohol with woolen cloth until the desired polish is obtained.

(4954) H. M. asks: Can you inform me through your valuable paper how to make a hard black cement or filling, something that will bake or dry hard, and not be affected by the heat generated in polishing the metal in which it is used? A. Use fine iron borings and sulphur, made into a putty, hot. Press it hard into the hole. 2. What substitute is there for nitric acid in the process of dipping brass work that will produce the same effect without raising fumes? I know there is something, and would like to find out what it is. A. Oxalic acid acts similarly to nitric acid, but is not as active.

(4955) H. B. asks: How many horse power would a constant stream of water of 2,000 gallons per minute produce with 40 feet fall through standpipe by means of a horizontal (or later style) turbine? A. The total value of the power as stated is 20 horse power, from which a net 17 horse power may be utilized.

(4956) W. F. B. writes: I desire to make inquiry of you as to the best method of restoring the tone of a large bell which is cracked. The dimensions of the bell are as follows: Height 2 feet, diameter at base 2 feet 11 inches, thickness 2½ inches. The bell is hung in the first Methodist church of this place, and was cracked by a crowbar or some other instrument falling on it from above. The crack is about 11 inches long, beginning 4½ inches from the base and one inch from place where clapper strikes, running diagonally up the side, upper end of crack being 13 inches from base of bell. I wish to know the best method of sawing out the crack and what width the edges of it would have to be separated to prevent their coming in contact by the vibration. A. Drill a half inch hole at each end of the crack and saw out the crack between the holes with a narrow stiff hack saw three thirty-seconds of an inch thick. A frame may be made of iron spanning the bottom of the bell, to hold the hack saw and keep it from kinking. The position of clapper stroke should be changed as far as possible away from the crack. If a swinging bell, it should be turned around. The clapper should also be made lighter to save an extension of the crack by excessive vibration.

(4957) J. S. T. asks: 1. What are the liquid products of oak wood and what is the best method of extracting them? What are they used for and what are their market values? What is the condition of the wood when the liquids are removed? Is it susceptible of receiving other liquids by boiling or pressure, if so, what is the best process? A. The products of oak wood are acetic acid, wood naphtha and charcoal. All the liquid products are marketed through the chemical trade. Charcoal finds a home market. Cannot quote price. The wood may be saturated with tar products for preservation. See Spon's "Encyclopedia," parts 1, 2, 3, on the distillation of wood, 75 cents each, mailed.

(4958) J. A. G., Quebec, writes: In your Notes and Queries, No. 4760, it is asked if aluminum could be tempered. A Canadian named F. Allard, of Levis, has discovered a process to temper that metal like steel.

(4959) S. D. L. writes: I am using for a sciopticon an oxygen gas bag made of rubber and canvas; the gas is made from chlorate of potash and black oxide of manganese. Suppose I fill the bag full and use only a portion of it. Is there any objection in any way to leaving the remaining gas in the bag, to be used at some future time? Does it injure the bag, or does the gas deteriorate? A. The gas bag is not liable to deteriorate to any appreciable extent, and the gas will keep well in the bag with a very small percentage of loss.

(4960) A. F. writes: Will you kindly inform me what head or fall of water is required to raise water with a ram say fifty feet over a distance of twelve hundred feet, water supply unlimited? A. Rams work at any fall from two to eight feet. They give the best results at the latter height.

(4961) D. E., Jr., writes: 1. Is there a telephone that can be bought outright which would be reliable for 1 or 2 miles? A. The electric telephone is not sold, but rented. 2. Would it be practicable to support a light wire for a vibrating telephone, from a heavier wire over it, by loops of light wire at proper distances? I had a very satisfactory vibrating telephone, but used a light iron wire, which when rusted would not bear the strain of taking the sag out. A traveling man put it up and put the poles too far apart. I thought I might run a heavier steel wire, and hang a light copper wire under it. A. Yes; with loops of elastic material. 3. What size wire would you suggest? A. Use galvanized telegraph wire for the main wire. 4. What is the best type of steam engine for use in a creamery where there will be no regular engineer? A. A vertical engine and vertical boiler on separate foundations. If not used constantly, a gasoline or petroleum engine will be perfectly safe and easy of management. See advertisements in SCIENTIFIC AMERICAN. 5. Also, the safest and most economical fuel. A. Coal is the safest and most economical fuel. 6. What is your opinion of an upright boiler and fast and slow speed engines? A. For small powers a vertical is preferred, with a medium speed engine. 7. What are the advantages of having a large boiler capacity? A. Easy firing and economy in fuel. 8. Has it any disadvantages in the matter of fuel, etc.? A. None. 9. Which is more economical of power, belting or gearing? A. There is very little difference; if any, in favor of belting. 10. What would be the difference in the saving of power in two cases as follows? 1. Belting, a chopping bar directly to an engine. 2. Belting to a line of shafting 75 feet long, and then to an engine. A. Power is saved with the least running gear, *i. e.*, directly from the motive power. 11. What would be the best method of communicating power from an engine, say 10 horse power, with perpendicular band wheel? If you would advise a belt, would there be any loss of power or other disadvantage as compared with both wheels in the same plane? A. We recommend belts for small power in all cases unless absolutely necessary to use gearing by short distances of centers. The use of a secondary shaft may be made for transmitting power to a distance to advantage.

(4962) Mason writes: Please state the most practical manner of removing a white incrustation which has formed on the surfaces of hard red brick used in the front of a building. Can it be rubbed off with a soft brick? Can an acid be used? What would be the effect of painting? The owners of the building wish this incrustation removed, supposing that, if once removed, it would not appear again; would it? And if it would, about what length of time before it would be seen again? A. The white substance encrusting the face of brick walls may be either carbonate of soda or sulphate of magnesia. They are derived from the lime containing soda salts or magnesia salts; pure lime makes no incrustating efflorescence. The usual method is to scrub the surface with a steel brush, then rub the surface with a soft brick; dry and oil with linseed oil. Weak hydrochloric acid will remove some stains. We do not recommend it, as it is very inconvenient to handle and care for on building fronts. When once cleaned as above described it will not give trouble for some time. After the oiling, a coat of paint will stop the efflorescence.

(4963) J. W. R. writes: I have built the eight-light dynamo which you illustrated and gave detailed drawings and specifications of some years ago. And I can say that I am only too proud of it, as it is a "dandy." It neither gets warm nor sparks, and gives a nice, fine, steady, brilliant light. And as this was my first experience in constructing dynamo-electric machinery, and I had such good success, I feel that I can construct a storage battery if I had a few more pointers in regard to the one you gave a cut of last month. What I propose to do is this: Charge the battery with my surplus current from 7 P. M. until 10 P. M.; then my machine shuts down and I want to run about 15 or 20 16-candle power lamps 110 volts the remainder of the night. My machine is a United States Weston system 300 ampere 110 volt continuous current shunt-wound dynamo. Now what I want to know is this: 1. What thickness should the sheet lead be, also the dimensions of same for 15 or 20 lamps? A. The thickness of the lead plates should not be less than one-sixteenth of an inch. 2. How many lead sheets shall I need? A. You should use about 15 plates per cell. For 50 volt lamps you will require 25 cells, for 110 volt lamps you will require 56 cells. The 50 volt lamps are generally used in connection with storage batteries. 3. How shall I connect in circuit in series, or same as my lamps are in parallel? A. Connect your cells in series and your lamps in parallel. 4. What can I substitute for glass for the cells? Something I could mould or cast myself, also how many shall I need? A. We know of no perfect substitute for a glass cell, but sometimes wooden cells coated with pitch are used. Such cells thoroughly soaked in paraffine have also been used. 5. If I charge from 110 volt current, could I use 50 volt lamps? Would the battery charge last longer for the same number of hours than if I used 110 volt lamps? A. The battery charge undoubtedly lasts longer when used in connection with high voltage lamps. 6. Could I charge the battery with my little eight-light dynamo 50 volts, provided I ran it long enough through the daytime? A. Yes.

(4964) A. B. C. asks how to make court plaster. A. Isinglass (best, genuine), 1 ounce; water, ½ pint. Dissolve by heating them together in a covered vessel, strain the solution, and when only lukewarm add to it gradually, but quickly, a mixture formed of rectified alcohol 2 fluid ounces, tincture of benzoin 2 fluid ounces. Apply this composition (still warm) by means of a flat camel hair brush, or any appropriate "spreader," to the surface of silk, or sarcenet, stretched in a frame, repeating the application as soon as the preceding coating is dry, and again as often as necessary (six to twelve times). Lastly, when quite dry and hard, give the prepared surface a "finishing coat" with a solution of Chio turpentine, 1 ounce; dissolved in tincture of benzoin, 2 fluid ounces. Tincture of balsam of Peru, or of styrax, may be substituted for the tincture of benzoin, and a few drops of essence of ambergris or of musk may be added to increase the fragrance of the compound. Some parties simply employ one or other of the above tinctures for the finishing coat, and others apply it to the unprepared side of the silk, by which the plaster is rendered partially waterproof, but the appearance of its exposed surface injured. Care should be taken that the first two or three applications of the gelatine composition do not sink into the silk, so as to appear on the right side, which will not be the case if it be only sufficiently warm to remain liquid, and be applied very thinly and rapidly, and with a light stroke of the brush or spreader. Use various colored silks, if desired. From the "Scientific American Cyclopedia of Receipts, Notes and Queries."

(4965) W. M. says: 1. Suppose a quantity of air be compressed to obtain a pressure of 1,000 pounds per square inch; what amount of heat will be generated also at 2,000 pounds? A. Air suddenly compressed to a thousand pounds pressure becomes red hot and sets fire to combustibles within the cylinder. This is the principle of the compressed air igniter. The ordinary method of compression to 1,000 to 2,000 pounds is by stages, with cool devices between the stages to keep down the heat. 2. What thickness of cast iron or copper will be necessary to safely confine the air at such

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pressure? A. The thickness of cylinder depends upon its size and the material. For cast iron a thickness of shell equal to one-sixth of the diameter. For bronze or copper one-eighth for moderate sizes. 3. Will the amount of heat generated be the same, whether the air be suddenly or gradually compressed? Where and at what cost could I obtain an air pump for such pressure? A. The heat generated will be the same, but will be partially absorbed by the cylinder in slow compression.

(4966) S. A. B. asks how to make a solution of Prussian blue that may be applied to unsized paper, so that it will not rub off, but will immediately be dissolved by water. A. Precipitate ferric chloride with excess of potassium sulphate. Filter the precipitate out and pour hot water through the filter paper. This will dissolve and give a solution of soluble Prussian blue. Applied to paper, it will probably be somewhat mordanted, so as to dissolve out with some difficulty.

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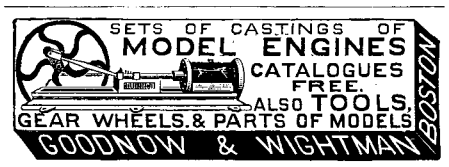

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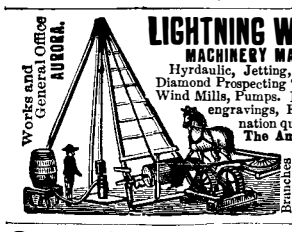

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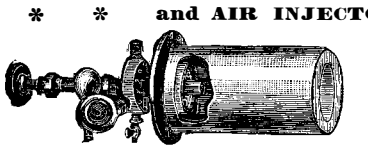

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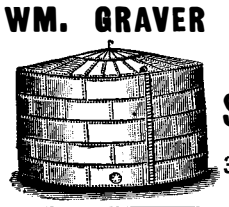

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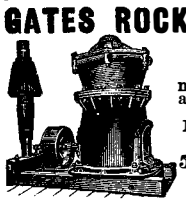

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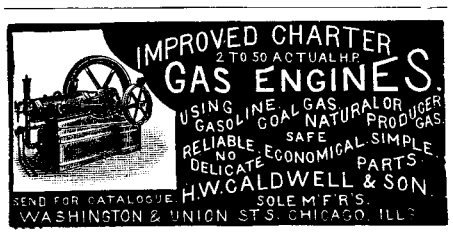

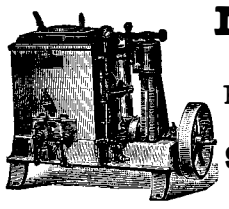

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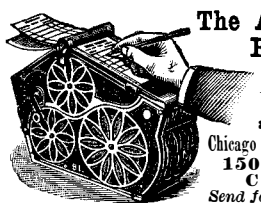

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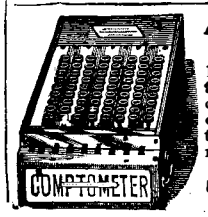

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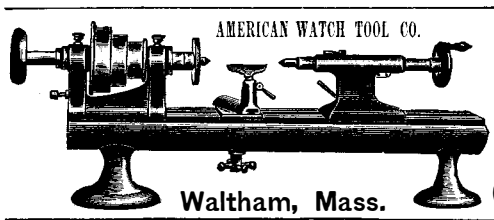

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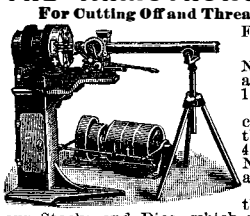

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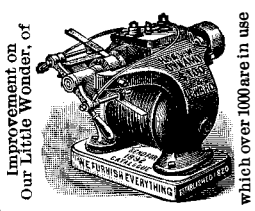

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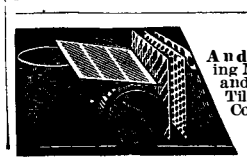

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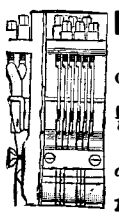

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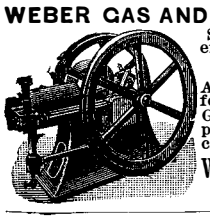

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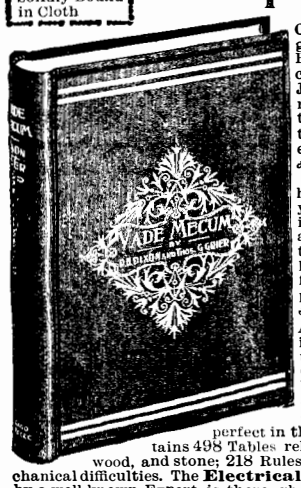

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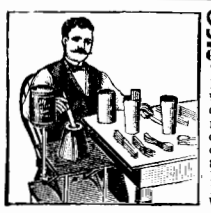

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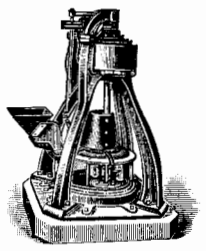

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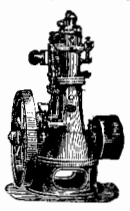

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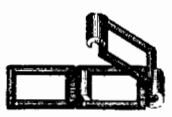

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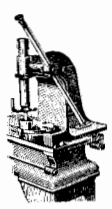

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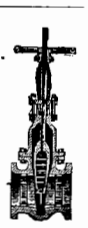

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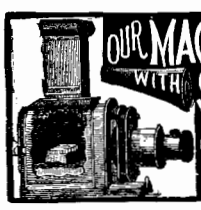

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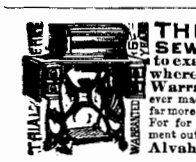

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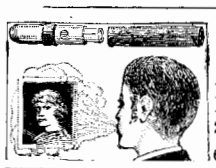

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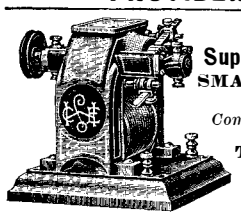

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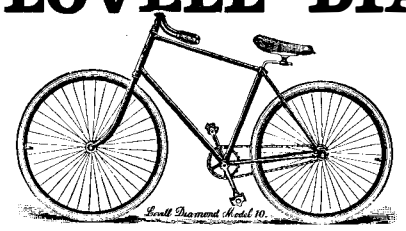

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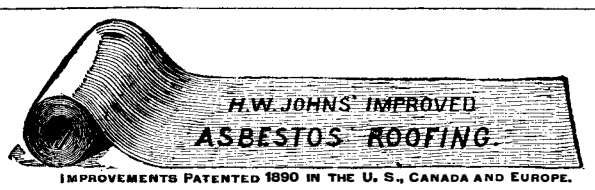

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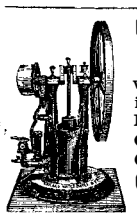

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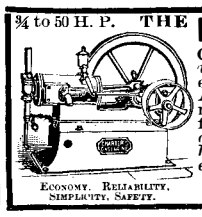

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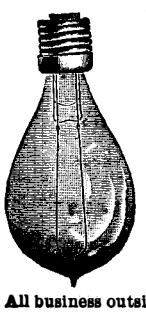

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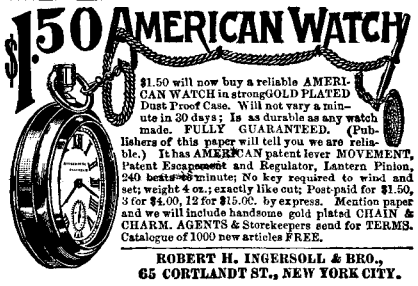

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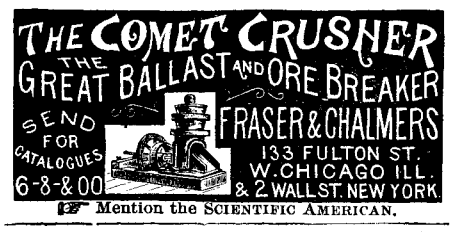
This Company also owns Letters Patent No. 463,569, granted to Emile Berliner, November 17, 1891, for a Combined Telegraph and Telephone; and controls Letters Patent No. 474,231, granted to Thomas A. Edison, May 3, 1892, for a Speaking Telegraph, which cover fundamental inventions and embrace all forms of microphone transmitters and of carbon telephones.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